The Journal

OF THE

AMERICAN DENTAL ASSOCIATION

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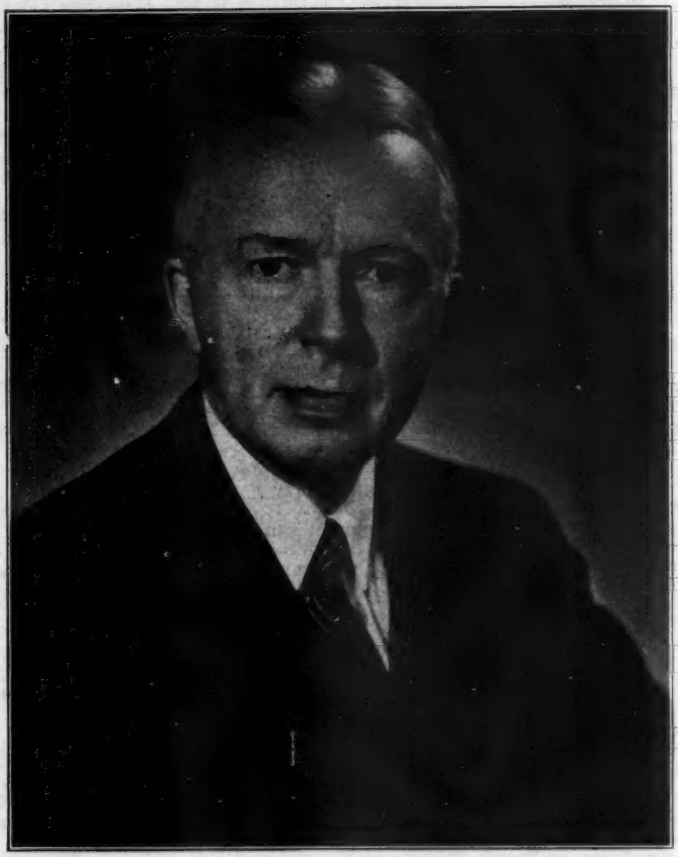

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PLANNING FOR POSTWAR DENTISTRY

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IN the midst of the war planning and war activities so dominant in this country at the present time, there is a growing undercurrent of speculation and concern as to what will come after the war. There are those who believe that there will be radical changes in our social order and economic status, that the Government and the State will be more concerned in the life and welfare of all the people than ever before, and that health service agencies will be made more available to rich and poor alike. This opinion finds considerable support in the recent health service programs that have been proposed by the Social Security Board, the National Resources Planning Board, the labor organizations and the farm security groups. A similar trend in England is clearly set forth in the Beveridge Report, and, in Canada, a plan has been proposed to care for the teeth of all children, 6 to 16 years of age, under governmental auspices.

The most recent proposal in this country is that embodied in the Wagner-Murray-Dingell Social Security Plan, introduced to the United States House of Representatives and the Senate, June 3, 1943. This bill proposes a system of insurance benefits and medical, surgical and hospital services to be provided for 15,000,000 people in the lower and median income groups on a compulsory participation plan. Although the medical benefits, which are to be administered under the direct supervision of the Surgeon General of the United States Public Health Service, are outlined in some detail, no plan is proposed for dentistry, nursing and other related benefits. These, it is stated, shall be studied by the Surgeon General and the Social Security Board, who are to report their findings not later than January 1, 1946. This bill is a further indication that in the formulation of the expanded Social Security program, as far as health is concerned, an attempt will be made to extend the services of dentistry to reach a larger percentage of the population than is served at the present time.

Dentistry has known for some time that it is failing to fulfil its obligation as a health service. Although the science

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of dentistry has been greatly advanced, and dental service in America is the finest in the world, the inescapable fact remains that only a small minority of people have enjoyed the benefits of such service as it is now administered. This was clearly shown in the early Selective Service draft by the large percentage of rejections based on dental defects. Approximately 70,000 dentists have been fully occupied in caring for the dental needs of 25 to 30 per cent of the people. If all dentists today are fully occupied by the dental needs of 30,000,000 to 40,000,000 people, the added task of providing even minimum health service for 15,000,000 more under present methods of practice would require a very considerable addition to the manpower enrolment in dentistry.

One answer to this problem, and by far the best, would be the discovery and institution of measures whereby the incidence of dental disease would be drastically reduced and the need for dental attention decreased. Then, perhaps, the present quota of dentists could cope with the needs of the nation. But, in spite of all the study of the means of controlling dental caries, that greatest single dental disturbance, teeth continue to decay and at a seemingly increasing rate. There are those who believe that decay can be controlled by an adequate diet and optimal nutrition. Unfortunately, this has not been proved to be true. During recent years, in which the dietary regimen of Americans has been greatly improved in quality and nutritional adequacy, and the truly dietary diseases such as scurvy, rickets and pellagra have been markedly decreased and definitely controlled, no similar decrease or control of dental caries has been observed. Furthermore, no acceptable evidence has been forthcoming that there is any means of fortifying the diet that will control this dental malady. To hold out to the public the hope that adoption of an adequate diet, irrespective of its sugar content, will prevent dental caries is cruel and unwarranted and serves only to discredit the profession that advances it.

It has been clearly demonstrated that the reduction of sugar and starch in the diet under carefully controlled conditions arrests dental caries and prevents the formation of new lesions. This method of disease prevention is practicable and is now employed successfully on a large scale by many laboratories and clinics in various parts of this country. For those who can avail themselves of this service, the activity of dental caries is definitely controlled, but unfortunately this method is not the answer to universal caries control. Too few people can be induced to forego sweets for the sake of saving the teeth. It is difficult to persuade many diabetics to follow this practice even when it is a matter of life and death. So this method, although highly effective, must be limited to the comparatively small number of persons who can avail themselves of it and are willing to make the necessary dietary adjustments.

In dealing with a disease that is as pandemic as dental caries, the only hope of adequate control lies in the employment of some easily administered remedy capable of universal or mass application; as in Michigan, where the occurrence of goiter was once very frequent, even though the administration of a few drops of iodine each week would protect a child from the disease, it was not until iodine was incorporated in table salt, and all children received a protective dose daily without their knowledge or conscious cooperation, that goiter ceased to be a major health problem. The same is true of chlorination of drinking water, to replace boiling, for the protection of the public from water-borne diseases. If some such subtle method of treating whole communities objectively by a principle which will decrease or control caries activity can be devised, this disease also will cease to be a major public health problem. The studies of fluorine now be-

ing carried on by the National Institute of Health are outstanding in this respect and give rise to the hope that dental caries may be subject to communal methods of control. Although the presence of fluorine in the communal water supply is associated with low caries rates, the mechanism involved in this relationship is not as yet clearly understood. The utilization of fluorine as a caries preventive on any large scale is not so simple a matter as is the use of iodine or chlorine. Rather is it attended by many complicating factors, which must be more clearly understood before it can be viewed with confidence as the answer to the problem of dental caries. It is, however, the most hopeful scientific approach to the problem that has thus far been found.

Although a clean tooth cannot decay, all attempts to control dental caries on any large scale by oral prophylaxis and dental hygiene have failed. Cleanliness of the teeth ameliorates dental disease in extent and scope, but no methods of cleansing capable of general application have been devised that will protect the teeth from caries.

Admittedly, then, there is at hand no method of controlling dental caries that is capable of practical application on a large scale to meet the needs of all the people. Consequently, we are forced to the conclusion that minimum remedial operative procedures constitute the only type of dental health service which we can offer at the present time to the population as a whole. Complete dental service for all people would be a colossal undertaking; one which, if attempted in its entirety, would stagger the imagination. Most students of this problem believe that any attempt at universal dental service should begin with children and be limited, at first, to the preschool, primary and secondary school age groups. It is possible that all children, if they could have adequate dental service up to 16 or 18 years of age, would have little need for such service during later life. Adult dental care for the next generation would then be much less a problem than it is at present. This assumption is supported by the recent reports from New Zealand and Sweden, where, as the result of a program of dental attention for all school children which has been in effect over a period of years, a definite decrease in the yearly incidence of dental disease has been observed. Since, under present-day conditions, adequate dental service for all age groups is a physical impossibility, the plan of leaving to the present generation of adults the services now available and of concentrating on complete dental care for all children has much to commend it.

The provision of necessary dental health service for 30,000,000 children in the schools of this country would in itself be a project of gigantic proportions. It would require the full-time attention of approximately one-half of the present number of practicing dentists. It would require an organization and reallocation of the dental manpower much more involved and comprehensive than the present war dental service. If, therefore, in the new order of social security, the needs of children should be stressed and dentistry should be expected to furnish adequate attention for the great majority, at least, the question of manpower seems inescapable. If there should also be a demand for at least minimal dental health service for 15,000,000 adults, the need for additional manpower would be even more imperative. Either the number of practicing dentists must be increased to provide necessary dental service for children and adults or the present methods of private practice must be radically changed to accomplish that end.

DENTAL EDUCATION

Considerable concern has been expressed during recent years over the fact that the dental colleges are not graduating a sufficient number of dentists to equal the total of those who are dying or

retiring, much less to keep pace with the rising demand for dental service. The demands made by the Armed Forces for dentists in war service have further accentuated the over-all shortage of manpower in civilian dentistry. This situation and the dubious outlook for the future are clearly set forth in a recent article by J. T. O'Rourke.[1]

There are some who believe that we have raised our educational requirements for the practice of dentistry too rapidly and that we are not yet ready for the present six-year curriculum. Undoubtedly, the length of the period of study and the cost of dental education have been strong deterrents to many young men who might otherwise have entered dentistry, but when we consider the importance of dentistry and the significant part that it is playing in health service today, the six-year program seems to be sound and well advised. Certainly, dental graduates should not be less well prepared than they now are to meet the obligations of dental practice.

The present four-year dental curriculum, preceded by a two-year academic training, has much to commend it. There is general agreement that two years of preprofessional training is educationally sound. It provides opportunity for the study of the basic sciences requisite to medical and dental education and it allows the pursuit of some cultural studies that should broaden the intellectual horizon of the student and give him at least an introduction to the arts and sciences. It also allows a two-year period of maturtion and experience, which will prepare him to cope with the professional training more successfully than he could upon graduation from high school. It would be unfortunate for the future of dentistry if circumstances should ever require the abandonment of the two years of predental college training.

1. O'ROURKE, J. T.: Analysis of Personnel Resources of Dental Profession. J.A.D.A., 30: 997, July 1943.

The four-year dental curriculum is the outcome of many years of evolutionary changes in dental education. For the present-day needs and status of dental practice, it seems to be adequate and educationally sound. By it, dentistry is taught as a highly technical and mechanical art contributing to the health of the individual. The technical instruction is founded on a comprehensive study of the basic medical sciences and dental-medical relationships. Since so large a part of the treatment and rehabilitation of diseased mouths involves technical procedures, it is necessary, in the training of the dentist, to develop considerable mechanistic and artistic skill. This includes many phases of operative and prosthetic service, some of which are thoroughly taught, while others are given only in introductory form. In most schools, so-called operative dentistry is taught most thoroughly; crown and bridgework, partial and complete prosthodontics, periodontia and exodontia somewhat less thoroughly; while oral surgery and orthodontics cannot be fully integrated into the undergraduate dental curriculum.

The objective of dental education is to train practitioners to function adequately as physicians and surgeons of the mouth, and as specialists in the field of public health service. The very considerable number of technical procedures involved in the treatment of dental disease and abnormalities has required the inclusion of so much mechanistic training that dental education has necessarily departed from the conventional pattern of medical curricula which has been followed by other specialties of medicine. In the four years, there must be less medical science and practice and more actual practical training in dental operative procedures in order to furnish qualified practitioners in the time allotted. Dental graduates, with their present practical training and the hospital experience which is afforded in most schools, are well prepared to

begin the practice of dentistry and to cooperate with medicine and public health agencies in dealing with problems of common interest in the health service of their patients.

MANPOWER IN DENTISTRY

During recent years, under the present six-year program, the number of matriculants in dental schools has been sufficient only to supply replacements and, until the beginning of the war, it showed no increase in relation to the growing population. As shown by O'Rourke, the prewar rate of dental education would, in the next ten years, serve only to maintain the present average of dentist: population ratio, approximately 1:1,850. This program certainly will not afford any appreciable increase in manpower to meet any future demands that may be made on dentistry.

Since Pearl Harbor, there has been some increase in dental school enrolments through the adoption of the accelerated teaching plan and the enlargement of dental school admissions virtually to the limit of capacity. However, under the present Army and Navy plan of subsidizing dental education, which has recently been inaugurated, the Government contracts for but 55 per cent of the capacity of dental schools. There are real grounds for apprehension that even this 55 per cent will not be reached. With the stipulation by the Army and the Navy that students admitted to dental schools under the Specialized Training Program must earn 85 credit hours of prescribed work, the number of applicants who successfully attain that goal may be small. This nearly 50 per cent increase over our present predental requirements may effect a reduction in the number of applicants for dental training and the number who will be able to qualify in the time allotted. At present, this ruling has not been put into effect. Students are still being accepted from the Army and detailed for the study of dentistry on the regular 60 hour basis. It is to be hoped that this practice will be continued in both the Army and the Navy for the duration of the war to avoid a drastic reduction in the number of such inductees in the future. The enforcement of the 85 credit hour requirements would unquestionably have dire effects on dental student enrolment.

Unless practical methods of Selective Service regulation shall be set up to provide for the predental and dental training of a sufficient number of youths to fill the remaining 45 per cent of available dental school enrolments, there will inevitably be a marked falling off of civilian dental trainees and dental graduates in the future. It is certain that the number of woman and of physically unfit man students cannot compensate for this reduction in dental manpower. A recent directive providing for the deferment of call to active military service of selected high school graduates to allow them to proceed toward dentistry has just been issued from Washington. This, it is hoped, may prove to be a practical answer to the problem.

All of these sources of dental matriculants depend on the individual voluntary choice of dentistry as a profession. In the past, there have been too few well-qualified applicants to the schools of this country to afford any adequate selection of these candidates. As a result, in order to fill their quotas, many schools have been obliged to accept too many poorly prepared or ill-adapted students, and there have been too few outstanding students capable upon graduation of outstanding professional achievement. It is well known that but few students in the older and more selective educational institutions choose dentistry. There are few rich men's sons who elect this profession. Although, before the war, dentistry was perhaps the least crowded profession and offered real inducements to the youth of this country, that fact was not generally known. Neither the students in colleges

nor their teachers, nor their vocational counselors, gave it any serious consideration in the choice of a career. There are thousands of young men who might have looked favorably on this profession in selecting their life work had they been aware of the opportunities which it affords.

If it becomes necessary to increase the manpower in dentistry by the enrolment of larger numbers of students in our present six-year program, it will be necessary to engage in some form of publicity or vocational guidance to call the attention of young men and women in preparatory colleges to the profession of dentistry as a life calling. Perhaps this publicity should begin in the high schools. Certainly, during the war, when the decision must be made between professional training and active military duty at the ages of 17 or 18, the high school students will be our ultimate and major source of professional school enrolment.

REALLOCATION OF MANPOWER

In many respects, our present methods of private practice of dentistry are uneconomic and inefficient. The limitation of the dentist to the four walls of an office and the service that he may render to a limited number of patients with his two hands alone does not fit into the picture of public health service. It is true that the private practitioner affords to a select few an ideal type of dental service, but it is difficult to see how the present methods of individualized practice can be made available to the masses. That is not to say that private practice should ever be discontinued; for it is, perhaps, only in private practice that the highest ideals of dental service may be attained; but when we consider provision of even minimal dental health service to millions of children and adults who are not now receiving attention, we must devise some more efficient procedure. Whether this will entail group practice of associated dentists with adequate dental hygienist, assistant and technician cooperation, or the institution of public child and adult clinics under public health auspices, is a question that remains to be answered. There is no doubt that the services of the private practitioner could be greatly amplified by the development of a larger number of ancillary aids to increase his efficiency and capacity. This is a matter that should have serious consideration; for if dentistry is to fulfil its mission in the new social order, it must be prepared to meet its obligations with the manpower available in the most efficient manner possible.

RESEARCH

As we have previously stated, the most practical and positive methods of meeting the challenge of dental health needs would be the discovery of some means of preventing dental disease that can be applied to the masses to decrease the need for dental service and the manpower to meet it. The control of so pandemic a disease as dental caries can be accomplished only by a method capable of general application. The discovery of such a practical means of universal control of the disease not only would be an inestimable boon to mankind, but also would enable dentistry to furnish adequate health service for the smaller number who would need it.

The most hopeful lead in that direction has been the fluorine studies made by the National Institute of Health and affiliated groups. If by the introduction of fluorine or some other substance in harmless quantities into the communal drinking water, all communities can be made as free from dental caries as are some areas in this country, the control of that disease will become a reality. It is unfortunate that these valuable studies have been somewhat retarded by the war. Studies of such significance to the human race should not be allowed to lapse or slacken their pace.

There are also hopeful indications

emanating from several sources that caries may be markedly decreased by the treatment of teeth so as to make them highly resistant to the action of acids, or that the attack may be reduced in severity by reduction of the oral acidophilus counts through medication. If practical methods of oral or dental medication can be devised that will be effective in decreasing caries and applicable to large numbers of people, the need for dental care will be greatly relieved. Studies of these methods of approach are now being made in various laboratories in this country.

Organized dentistry has talked glibly and long about "prevention," but it has done relatively little about it. There has been too much wishful thinking that a general improvement of the diet or more sunshine or vitamin D milk will automatically bring about the desired result, but these fond hopes have not been realized. In view of the need that has been presented, it is high time that dentistry take concerted action in furthering the studies of water-borne protectives and dental immunization for the benefit of the masses. The American Dental Association could make no more notable contribution to the welfare of society than to encourage by all possible means and to afford ample financial support to the studies of those methods of caries control which are of practical application to all people. If, through its organization and support of research, dental caries is definitely controlled or markedly reduced in its rate of occurrence, dentistry will win the gratitude of all mankind and will establish forever its position as an important branch of the healing arts.

HEALTH EDUCATION

We hear a great deal today about dental health education. This, indeed, is one of the chief activities of dental health service. The question may well be asked, however, *How much do we really know about the prevention of dental disease that can be taught to the masses other than the value of a clean mouth and the importance of frequent dental examination and the filling of cavities while they are still small?* Much that is said about the benefits of an adequate diet applies only to the general health of the child. Unless the sugar intake is definitely restricted, dietary adequacy has little effect on dental health. Even with the closest cooperation of the parent, the dentist and the pediatrician in the selection and feeding of optimal diets, new cavities appear in the teeth of children with extraordinary regularity. If the sugar intake is properly limited in the diet, there will be little or no dental decay, irrespective of the adequacy or inadequacy of its nutritional values. This is the only dietary modification which we are at the present time justified in offering to the public as a preventive of dental disease.

Let us not forget that, when cavities appear in the teeth, there is no known method of treatment by which these lesions may be healed. The only possible control of cavities already formed is through dental operative procedures and these require manpower. When we consider the millions of children whose teeth are constantly decaying and who must have adequate dental attention if their health is to be protected, the question of manpower becomes a cogent factor in the solution of the problem. If the Surgeon General of the United States Public Health Service should ask the dental profession for a plan whereby all children as well as adults in families earning less than $3,000 per annum may be afforded adequate dental attention, we should be prepared to meet the challenge, not with high sounding phrases, such as "social and economic factors," "diet and nutrition" and "oral hygiene," but with a practical approach which will squarely meet the conditions that actually exist.

ELECTROSURGICAL RESECTION IN THE TREATMENT OF PERIODONTAL DISEASE

LEVON M. SAGHIRIAN,* D.D.S., Philadelphia, Pa.

THE positive elimination of foci of infection of periodontal origin is a definite contribution to public health. Clinically, the study of periapical infection, often overrated in importance, usually supersedes any consideration of acute or chronic gingival and periodontal diseases, which frequently may present active foci of infection. These foci may be potent factors in the dissemination of infection by absorption into the vascular and lymphatic systems, by inhalation into the lungs or direct ingestion into the gastrointestinal tract. It is therefore fitting, particularly in these days of war and food rationing, that more attention be given by dental and medical practitioners to a study of gingival pathology in the interest of oral and systemic health preservation.

A complete understanding of the fundamental principles of periodontology is the basis on which periodontal disease is treated. In recent years, through clinical research, newer methods of therapy have been advanced, so that it is now possible, without resorting to removal of teeth, to eliminate promptly deep periodontal pockets that have failed to respond to conservative treatment. As a consequence, affected teeth that were formerly considered hopeless are retained for prolonged usefulness; whereas their abrupt removal might cause immediate and at times serious nutritional and systemic disturbances by crippling the masticatory apparatus and, at an inopportune time, complicating the general medical treatment of the patient.

In a survey conducted among the inmates of San Quentin Prison by Sweigert, Gobar and Bartlett,[1] the following results of surgical treatment of periodontal cases and its effect on the general health of a controlled group were observed. The symptoms of 75 per cent of the patients were alleviated shortly after surgical treatment. No evidence of systemic damage was noted six months afterwards on careful medical examination. In this survey, it is further emphasized by the authors that periodontosis should always be regarded as a source of danger to the general health of the patient.

Shallow pockets may respond to therapeutic measures alone. Thorough prophylaxis, careful subgingival curettage, gum stimulation and mouth rehabilitation may be sufficient to reduce the abnormal crevice to a normal gingival crest.

Deep gingival crevices may also respond favorably to conservative treatment through the control of inflammatory processes, and the teeth made comfortable temporarily. Unless a physiologic recession ensues, however, these pockets will recur in time, becoming progressively deeper and being subject to reinfection. Lundquist[2] warns us that, as long as the crevice exists, a chronic disease process is present. Surgical or electrosurgical resection of the soft tissue side of the infected pocket makes the diseased area completely accessible to therapeutic measures.

In the clinical management of a case,

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Read at the Sixtieth Annual Meeting of the Maryland State Dental Association, Baltimore, May 3, 1943.

a stomatologic study, case records and a definite routine are essential. The value of full-mouth and bitewing examination in periodontal disease as a diagnostic measure is not to be minimized, and yet it is not a factor of conclusive importance. The roentgenographic study may indicate the extent of bone resorption and remaining bone attachment, but probing and measuring of the depth of the crevice around each tooth will often determine the prognosis.

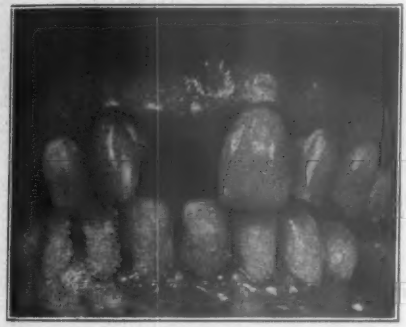

Fig. 1.—Preoperative appearance of mouth of middle-aged woman. The lower incisors are loose. (Compare Figures 2-5.)

Fig. 2.—Extensive bone resorption.

In periodontosis, whether or not a tooth may be retained depends on the operator's judgment and ability. The so-called regeneration of tooth attachment following periodontal treatment is in fact no more than recalcification of previously retained organic matrix of the bone which takes place with the elimination of soft tissue disease and readjustment of the physiologic state. (Figs. 1 to 5.)

Taylor[3] states that the pocket which is formed is never so deep as the roentgenogram shows it to be, and if the cause of inflammation is eliminated, the lime salts will be redeposited in the organic matrix that remains.

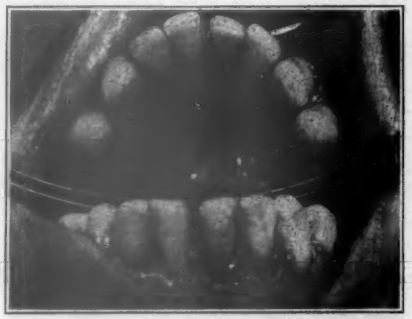

Fig. 3.—Soft tissue resection.

Fig. 4.—Appearance of case shown in Figure 1, three months later. There is regeneration of bone by recalcification of the undisturbed and retained bone matrix.

Kronfeld[4] also asserts that a return to normal conditions in the epithelial and subepithelial tissues may be expected when the source of irritation is removed and the patient is instructed in the care and brushing of the teeth. Therefore, whenever possible, the protection of sup-

porting alveolar bone against injury or loss is advisable; and, in line with the newer concepts of histopathology, radical procedures of bone curettage and filing should be avoided.

Goldman[5] considers this not only unnecessary but injurious, stating that not only should alveolar bone be left alone, but also curetting of the tissue should be avoided lest some of it be needlessly lost. The only legitimate reason for removing alveolar bone in periodontal treatment is an architectural one.

Fig. 5.—Postoperative condition of mouth (Figs. 1-4) three months after treatment.

Fig. 6.—Step 1 in resection technic: Festooning with elliptical loop electrode.

Kirkland,[6] in discussing bipolar electrocoagulation at the Dental Centenary Celebration, pointed out its limitations, reiterating that electrocoagulation, though effective in the removal of gingival tissue overlying the periodontal pus pockets, does not possess mysterious healing powers. In his opinion, the surgical method is, in comparison, less painful and the extent of tissue removal can be definitely controlled. However, he further predicted that a more practical method may yet be found for the application of electric current in the treatment of periodontal disease.

THE ELECTRIC KNIFE

When surgical procedures are indicated in periodontosis, the electrosurgical scalpel (electric knife) has definite advantages over the steel knife. Electrosurgery provides a cleaner and drier field of operation. The fine monopolar scalpel, operating from a tube type high fre-

Fig. 7.—Step 2 in resection technic: Making of conical incisions with straight wire electrode.

Fig. 8.—Step 3 in resection technic: Planing with round wire electrode.

quency unit, serves as a sterile, deliberately controlled, extremely keen knife, cutting without pressure and sealing the lymphatics and capillaries as the cut is made. When long-wave diathermy is used, the coagulation area is very shallow and is under control. All diseased tissue is either removed or exposed by wire electrodes, while bleeding and oozing are controlled by the ball type electrodes. Posterior teeth and their bifurcations may be reached more easily by the electrodes than with the knife; a distinct advantage.

Fig. 9.—Periodontosis. The lower anterior region had been resected two weeks earlier and the stainless steel wire ligature is in place. (Compare Figures 10-14.)

Fig. 10.—Application of elliptical loop electrode. Local anesthesia was supplemented with nitrous oxide analgesia.

With proper frequency and wave form, the heat generated in the tissues by high frequency current can be concentrated in a small area, severing the tissues ahead of the electrodes and causing a fine coagulation along the line of cleavage. In using the spark gap unit, where coagulated tissues are allowed to slough off, deep penetration will result in excessive after-pain, devitalization and systemic disorders due to heavy absorption of toxins. Bipolar electrocoagulation from a tube-type oscillating current is, on the other hand, slower acting, less penetrating and therefore safer.

Fig. 11.—Resection completed; showing architectural form attained.

Fig. 12.—Surgical pack applied buccally and palatally.

The simple dehydration of tissues—fulguration or electrodesiccation—produced by the short high frequency sparks of a spark gap unit will result in the creation of moderate body heat. In

bipolar electrocoagulation from a high frequency unit, the current is of such character as actually to boil tissue juices or coagulate protein matter. The judicious use of these modalities has its limited, but definite fields of usefulness. In contrast, electrosection—acusection—makes possible a refined technic. The extent of tissue removed can be readily controlled, esthetic results in gingival outline are possible and tissues heal firmly and with excellent tone.

Fig. 13.—Appearance of case one month later.

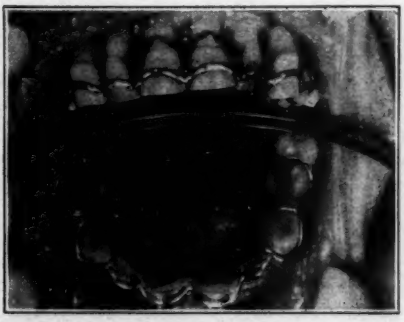

Fig. 14.—Continuous bar splint applied to upper jaw for stabilization and fixation of weakly supported teeth.

Owing to the keenness and rapidity with which the electrodes advance, manual agility and predetermined direction are essential. The operator must acquaint himself with the use of high frequency current and develop a high degree of efficiency in handling electrosurgical units with speed and confidence, avoiding duplication of motion and not underestimating the potentialities and limitations of electrotherapy. In electrosurgery, overuse must be avoided.

It is therefore evident that this technic will have to be developed through experience, the beginning operator relying on advanced technic and clinical instruction for an increase in percentage of success.

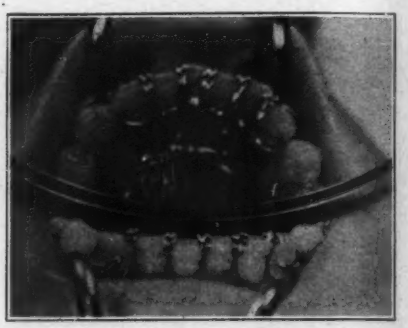

Fig. 15.—Lingual view of prosthetic restoration balancing articulation and permanent fixation of teeth by means of multiple incisal rests. (Case shown in Figures 9-13.)

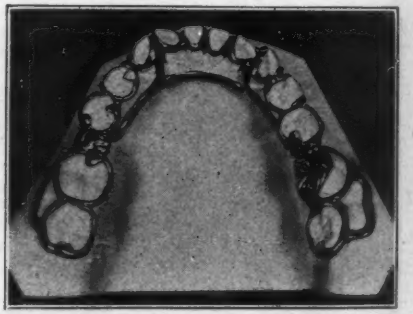

Fig. 16.—Removable splint constructed of rigid light weight precious cast metal surveyed and designed to support each tooth.

PERIODONTAL ELECTROSURGERY

The purpose of periodontal electrosurgery is to extirpate the soft tissue side of pockets and so carve the tissues as

to produce interproximal sluiceways and deflecting contours. This can be done either by gingivectomy or by the individual resection technic. With either method, immediately after a thorough examination of the patient, steps are taken for the localization and reduction of acute symptoms. At the first opportunity, a thorough prophylaxis is given. Infiltration or regional anesthesia may be supplemented by nitrous oxide analgesia. Explosive anesthetics must be avoided. If general anesthesia is desirable, intravaneous anesthesia with pentothal sodium, with an adequate supply of oxygen, will prove suitable if administered in the hospital operating room.

Fig. 17.—Periodontosis in woman aged 35. (Compare Figures 18-19.)

Fig. 18.—Extensive recession; wire splint in place. Resection of the whole mouth in sections was undertaken.

GINGIVECTOMY

This technic simulates the conventional surgical routine. The knife is supplanted by a straight wire or fine blade electrode. A continuous incision is made to the depth of the pockets, buccally and lingually, following the gingival outline. The strips of tissue are dissected and removed. The interproximal granulation tissue may then be trimmed and removed with the electrodes or by curets. The wound is subsequently protected by a surgical cement pack, which is allowed to remain in place for about a week, and the wound thereafter receives

Fig. 19.—Condition of mouth shown in Figures 17-18, one year later; showing regeneration of gingival tissue without pockets.

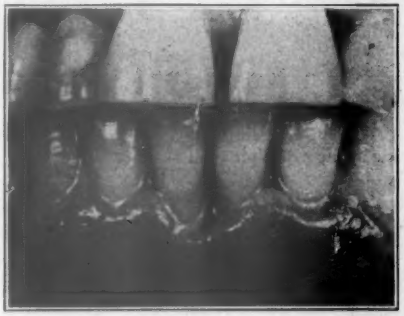

Fig. 20.—Condition of mouth of man aged 37 under periodontal treatment for fifteen years. There are deep pockets and the gingivae are congested. (Compare Figures 21-22.)

chemotherapy and physical therapy, until healing is completed.

INDIVIDUAL RESECTION

The technic of individual resection, developed since 1935 as a result of clinical research at the dental clinic of the Graduate Hospital and in private practice, is a conservative procedure. With this method, the loss of tissue is reduced to the minimum as each pocket is treated separately. Only one section of the mouth, preferably one-sixth, is treated at a time. We have found this procedure to be within the normal limits of tolerance of the average individual.

The technic is carried out in a short time, with the patient, as a rule, comfortable and relaxed. Using a current of the proper wave form and frequency, which will cut fast with minimum coagulation, the following three steps are applied:

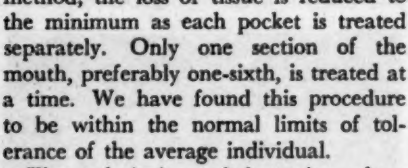

Fig. 21.—Resection of lower pockets; showing symmetrical gingival outline.

Step 1. The elliptical loop electrode is used for festooning. Marking the depth at first, a crescent shape tissue is extirpated, buccally and lingually to the depth of the pocket. (Fig. 6.)

Step 2. The straight wire electrode is applied for conical incisions into the interproximal area, connecting buccally and lingually the two cuts. The result is the formation of a natural sluiceway or a clear interproximal channel. (Fig. 7.)

Step 3. The round loop electrode is used for planing. All ridges and shelves produced by previous incisions are leveled and carved to produce deflecting contours. (Fig. 8.)

Immediately after resection to the desired architectural form, the wound is thoroughly cleaned of débris and covered with a surgical cement pack. (Figs. 9 to 12.) In from seven to ten days, when the pack is removed, the healing wound is gently irrigated with a warm soothing antiseptic lotion. The treated teeth are braced with stainless steel wire (DIA 0.010) for stabilization and to make the patient more comfortable. This procedure is particularly indicated in anterior regions. Occlusal trauma is corrected by grinding cusps and incisal planes. The balancing of the occlusion may require bite-opening appliances and the building up of the teeth with onlays. During the period of treatment and tissue repair, weakly supported teeth must be protected against undue stress and further luxation and wandering. (Figs. 13 and 14.) Splints and other means of fixation should be of simple construction and easily kept clean. They should be lightweight and preferably removable. (Figs. 15 and 16.)

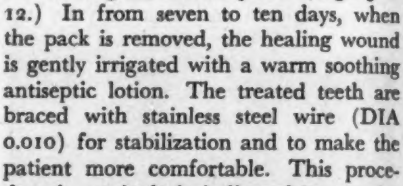

Fig. 22.—Case shown in Figures 20-21; six months later. The condition is now under control.

Postoperative treatment is to a great extent symptomatic. Bland mouthwashes

are indicated, and sedation in general and soothing oily analgesic desquamating local agents are used.

Partial healing takes place in about two weeks, after which the patient is usually comfortable. Freshly granulated tissues are protected by application of a wax-cocoa butter pack, which may be replaced every twenty-four to forty-eight hours, until such time as, in the judgment of the operator, an intact epithelial lining has formed. Complete healing may take place in a month or more, but it will progress faster if interdental stimulation, rubber cup massage and a proper brushing technic are prescribed and home care is emphasized to the patient.

Medical cooperation should be instituted in the incipient and therefore preventable phases of periodontal disease. Particular emphasis is laid on the diet and nutrition of the patient, with the essential vitamins and minerals. In oral disease, prior to intensive treatment, the objective is to get the patient in the best possible condition locally and physically. If there is definite regression of alveolar bone associated with deep pocket formation and other local symptoms, medical treatment alone is not able to cope with the situation. The prompt elimination of the pocket and its contents, obtained by following an effective technic and establishing the desired mechanical form, induces Nature to build her new defenses. (Figs. 17-19; 20-22.)

CONCLUSIONS

Our clinical observations lead us to believe that, after electrosurgical treatment, the tissues are reactivated and a reasonable degree of tissue regeneration may be expected, so that, with the establishment of a symmetrical gingival line, the esthetic results are satisfactory. Exuberant granulation can be controlled by the reapplication of electrosurgery or by means of caustics. If sufficient bone support remains and precautions are taken against reinfection of fresh granulation tissue in the wound, we have found recovery to be rapid, with little discomfort to the patient. Denuded bone, when left alone, will eventually resolve, though occasionally it may sequestrate in doing so.

After resection of the pocket, the soft pliable scar tissue is gradually transformed into the connective tissue and epithelium of the oral mucosa. Histologically, in the early stages of healing, the corneum is very thin and much too delicate to withstand an unreasonable amount of abuse, and it may bruise easily in brushing. At the earliest opportunity, means must be provided to toughen this epithelial lining and thicken the corneum, in order that the underlying connective tissue may be adequately protected against irritants. The final results of resection in advanced periodontal disease resemble physiologic recession, when interproximal areas are accessible, and deflecting contours are reproduced. The importance of home care and local stimulation, mainly through massage and prophylactic care at frequent intervals, is stressed in instructing the patient. Cooperative medical care, particularly as regards diet and nutrition, is essential from the standpoint of permanent results.

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Walnut Park Plaza.

CONTRIBUTIONS THAT RESEARCH HAS MADE TO ASSIST THE PRACTITIONER IN THE CONTROL OF DENTAL CARIES

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So many articles have been written on the subject of dental caries that a mere reading of the titles would fill more than the allotted time for this presentation.

The purpose of this paper is to review briefly some of the more significant contributions and in such a manner that it may be of service in the practice of dentistry. Frequently, we hear the statement that many research reports on caries are interesting but not practical. May I add that nothing is practical unless and until it is practiced? While some of the very best works on the study of dental caries may not have immediate practical application by the clinician at the present writing, they may be important for the workers in the fields of biochemistry, bacteriology, pathology, nutrition, etc., in furthering our understanding of the disease processes. Ultimately, the results of the numerous basic or fundamental projects will become highly practical for the clinician. This paper, then, is not to be considered as a report on any one research investigation, but is prepared as a discussion of the caries problem with the hope that some of the facts which we have at hand may become "practical" for the clinician.

From the Walter G. Zoller Memorial Dental Clinic, University of Chicago.

Read at the Seventy-Ninth Annual Midwinter Meeting of the Chicago Dental Society, February 23, 1943.

BACTERIOLOGY

The science of bacteriology has played an important rôle in the development of our present-day knowledge of caries. I would not be challenged, I believe, should I state that dental caries is the result of bacterial activity. However, should I venture to state that the active or exciting agent in caries is one certain micro-organism, I am sure that a debate would follow. It is possible to go even further in our differences of opinion and state that one school of thought has given up the idea that enamel caries is caused by enamel decalcification by acids, in favor of the idea that bacteria penetrate the enamel sheaths and, by proteolytic action, cause the disintegration of sound enamel.

The large majority of students of the subject hold to the belief that local—i.e., tooth surface—environmental conditions act as predisposing factors, while others[1] contend that deranged or altered movements of tissue fluids within the enamel and dentin may play an important rôle in the development of surface lesions. To the investigators, this difference of opinion is stimulating, and it also indicates that a sufficient amount of undisputed evidence has not been presented. Those interested solely in the clinical application of our knowledge should not be confused or discouraged by such an honest difference of opinion. To the contrary, the clinician must be the ultimate judge, passing upon the merits of

all researches dealing with the etiology, prevention and treatment of disease. The clinician should read a certain number of these research reports; and if he will read these articles critically, requesting that investigators submit in their presentations a sufficient quantity of scientific data to support their deductions, he will frequently be able to contribute much that has an important bearing on the subject. Also, he would note a great improvement in the quality of the material presented for his consideration. All of this is just another way of saying that the clinician is expected to enter into some of the discussions of an investigative nature and to temper the conclusions reached by the laboratory worker with the experience which develops from careful, systematic observations and study in practice.

All are familiar with the fine work of the Michigan Group who, if I interpret their findings correctly, conclude that *Lactobacillus acidophilus* is the exciting or activating agent in caries. They have based their opinion largely on the fact that they have been successful in the recovery of large numbers of these organisms from the saliva of patients having several active lesions; or, conversely, they have failed to recover these organisms when caries was absent. These findings have been confirmed by other laboratories. While, at first blush, this seems a logical conclusion, with time for more deliberate thought it appears that one has the privilege of asking for more evidence before accepting the conclusion that *Lactobacillus acidophilus* is the active agent in dental caries. As has been stated frequently, whatever the micro-organism that is responsible for the development of the initial lesion, it is freely admitted that it must be present for some time (how long is not known) before the earliest lesions can be recognized.

In order to know whether a given bacterium precedes the development of the lesion, it is necessary to determine the presence of all clinical lesions that may be recognized, using every means at our command. While a scrutinizing clinical examination following adequate separation of approximating teeth will suffice to reveal many early proximal lesions, it is worthy of note that, in order to state definitely that no lesions are present, such a clinical examination must be supported by evidence obtained with critical bitewing x-ray films. Even with such a detailed clinical and roentgenologic study, it is impossible to state dogmatically that no subclinical carious lesions exist.

Several reports have appeared[2, 3, 4] which at least question the validity of a method of determining caries activity solely upon the data obtained by clinical examination with mouth mirror and explorer and by cultures of activated saliva for aciduric micro-organisms. These reports indicate that many initial lesions may develop without the recovery of such micro-organisms either in direct cultures from the tooth surfaces or in the salivary specimens. However, as these initial lesions increase in size, the discovery of such a bacterial flora becomes increasingly common. In any disease, we must be careful to differentiate between the exciting agent and an agent secondarily associated with the disease process. I am not saying that the presence of the lactobacillus is not the cause of caries. However, I do say that, to date, sufficient indisputable evidence has not been submitted to substantiate the claim that this organism is the sole etiologic agent. Whatever the ultimate outcome of future studies on this question may be, the fact remains that dental caries is generally considered to be the result of bacterial activity.

With this premise in mind, may we consider some of the conditions that will increase or hinder this activity. Since

the time of W. D. Miller, we have been told that the production of lactic acid by the bacterial plaque resulted in enamel decalcification. Interestingly enough, it remained for another worker by the name of Miller to examine critically the carious lesion for the presence of lactic acid or its salts. After developing a new ultramicrotechnic for the determination of lactic acid,[5] he succeeded in demonstrating the presence of this acid in the material removed from carious lesions of teeth *in situ*. However, the findings were not constant enough to permit the statement that lactic acid is always found in carious lesions or that its concentration is sufficient to explain the removal of the inorganic salts of the hard tissues. Miller advanced the hypothesis that other organic acids probably played an important rôle.

Stephan[6] first demonstrated that the bacterial plaque on accessible (labial or buccal) surfaces following the application of glucose very rapidly developed a pH sufficiently low to cause the dissolution of enamel. More recently, he has perfected his technic for such *in situ* studies and has announced that he is able to repeat the experiment many times and obtain constant results.[7] The clinician should be encouraged by Stephan's significant findings that when the teeth are thoroughly brushed, the characteristic drop in pH does not follow the application of a solution of glucose.

In general, dentists do not appreciate the fact that acid is produced within two or three minutes after the application of a substrate containing a readily fermentable material; also that, after the initial drop, the pH gradually rises in an hour or so to a point above the critical level for the dissolution of enamel. It is evident from the studies of Miller and Muntz[8] that the diffusion of substrates through the plaque material is largely dependent on concentration of the substrate. There is no evidence to support the hypothesis that the plaque is a semipermeable membrane. Recently, Muntz has shown that the normal buffers of the saliva do not inhibit production of acid by the micro-organisms. To demonstrate this, he utilized a poured agar plate containing streptococci and bromthymol blue as a color indicator. Within the center of the plate, he produced a cup or well by stamping out a small portion of the agar. In this well was placed a solution of heated saliva containing 20 per cent glucose. Within a few minutes, three distinct zones could be visualized. The first, nearest the cup, was a dark blue zone—the alkaline zone. Second was a wider zone wherein the organisms in the agar had formed sufficient acid to change the color of the agar to a distinct yellow. The remainder of the agar plate retained the original green color. This experiment suggests that, in the undersurface of the plaque, the buffering effect of the saliva is very low when compared with the rate of acid formation. It is often stated that caries occurs more frequently in those areas of the oral cavity that favor the stagnation of saliva. The foregoing demonstration is offered at least to question the propriety of such a statement.

Thomas Hill has reported on studies[9] designed to determine what influence the saliva may have upon the growth of lactobacilli. He found that either filtered or centrifuged saliva from caries-free mouths to which a 2 per cent dextrose was added will not support the growth of these organisms and that the saliva from mouths of those who are susceptible to caries will support their growth. This has led him to the conclusion that "caries susceptibility is to some extent due to the presence in or absence from the saliva of some substance which is inhibitory to the growth of *L. acidophilus*." In another discussion of the subject,[10] he states that "it has not been

shown but it is suggested that this might be the result of some immunologic reaction."

Williams and Harrison[11] have studied the sensitivity reaction in the skin of laboratory animals to the lactobacilli. They found a marked reaction of the antisera to the carbohydrate extracted from homologous strains and sometimes a positive reaction to carbohydrate from heterologous strains. These and other basic studies in immunology offer considerable promise for the development of a better understanding of ways and means of preventing or controlling caries.

In a private communication, B. F. Miller summed up the matter of acid formation concisely in the following statement:

> From the results obtained thus far, it is apparent that degradation of carbohydrates by the mixed flora of plaque material is a complex process that cannot be ascribed to any one organism, but rather is the result of many organisms metabolizing in different ways. It serves to emphasize that only a limited knowledge of the carious process can be obtained by working with pure cultures of bacteria.

NUTRITION

I know of no other condition in which the matter of nutrition is more debatable or is in greater need of clarification than in dental caries. About the only positive statement that one can make regarding the relation of nutrition to the etiology of dental caries, without being challenged, is that there is a great need for carefully planned and controlled long-term experimental studies. Many articles based on wishful thinking and incomplete data have been offered. Too many statements pro and con have been based upon dietary records developed by single or occasional patient interviews.

Recently, Huenemann and Turner[12] have shown that to obtain information which is at all acceptable requires a dietary record based on weighing all of the food intake for at least a two-week period, a minimum of three or four times a year. They found a marked difference in the results when data gathered in this manner are compared with those obtained by means of an interview. This report appears to have sufficient significance to justify questioning the value of all data obtained by other methods unless the number of cases studied is so large that the errors can be determined statistically. Current literature contains several research reports indicating that administration of vitamin D after the time of tooth eruption is of value in the reduction of caries; also, that the incidence of caries is related to the total hours of exposure to sunshine. We know of the importance of vitamin D in the development of teeth and bones, but no one has offered conclusive data as to how it may act to reduce caries activity.

We should not confuse the effects obtained by the use of an adequate diet properly fortified with all the accessory factors with those obtained by the use of vitamin D either in massive single doses or by daily administration. If it should be true that the incidence of caries varies according to a seasonal rhythm, the proponents of this theory must attempt to explain the phenomenon. Every one with much clinical experience is familiar with the fact that considerable time is required (months, not weeks) for a proximal surface lesion to begin and to develop sufficiently to be recognized by the usual type of clinical examination. If that is true, it is necessary that convincing evidence be submitted that no early or subclinical lesion existed prior to the period of observation.

The Michigan group have ardently contended that an excessive amount of carbohydrate in the diet, and particularly the refined sugars, is largely responsible for the high incidence of caries. They[18] have shown that a decided drop

in the number of lactobacilli in the saliva follows a sharp reduction in carbohydrate intake. In their opinion, the reduction in the fermentable fraction of the diet is more important in the control of caries than provision of a diet adequate in all respects and supported by the accessory factors.

The field of human nutrition contains many pitfalls. It is one thing to use laboratory animals in a feeding experiment and quite another matter to use human beings. Whether one believes that the principal factor in the control of caries from a dietary point of view lies in the reduction of carbohydrate or in the use of an adequate diet, the following quotation from Boyd is pertinent:

> The child with active caries must be considered to have a disturbed metabolism, and this can be corrected most effectively through enrichment of the diet so that it will favor an optimum state of nutrition. Such treatment is conservative. It cannot lead to harm if carried out with insight, and it conserves not only the teeth, but also their possessor.[14]

CHEMOTHERAPEUSIS

The introduction of the sulfa drugs as chemotherapeutic agents has revived the search for some substance with which caries can be controlled or prevented. Some years ago, Bunting used hexylresorcinol and metaphen, but without encouraging results. To our knowledge, a specific for the control of caries does not exist at the present time. However, should there be announced tomorrow a compound which required daily application to achieve the desired results, it is safe to say that the public at large would not be diligent in its use. Dental caries will continue to destroy the teeth of man until some simple immunizing technic similar to vaccination is developed.

Not to appear too pessimistic in this regard may we add that considerable progress is being made. The fluorine content of drinking water has been shown to reduce materially the incidence of caries in areas of endemic fluorosis.[15] Armstrong and Brekhus[16] have shown that non-carious teeth contain a greater amount of fluorine than those showing caries even when taken from the same individual. B. F. Miller[14] demonstrated on rats that the addition of sodium fluoride or iodoacetate to a caries-producing diet noticeably reduced the incidence of caries. If the use of drinking water containing small amounts of fluorine will retard caries, why is it not possible to administer a sufficient amount each day to those who live in non-endemic areas in order to reduce the incidence of dental caries? The reason is simple. Fluorine is a very toxic chemical. We do not know the amount of fluorine daily ingested in our food. The amount depends largely on where the food came from and the fluorine content of the soil that produced it. We do not know how much fluorine the body can ingest daily over a period of years without clinical symptoms of intoxication. Until such knowledge is available, we cannot consider its use as an agent to prevent or control caries.

Work of a fundamental character on the chemotherapeusis of caries has been reported by Baker, Harrison and Miller,[18] showing that, in dilute solutions, the synthetic detergents are extremely active *in vitro* in arresting the metabolic activity of organisms obtained from the dental plaque.

Recently, Stephan[19, 20] pointed out that concentrated solutions of urea would inhibit acid production by the dental plaque. Wach, O'Donnell and Hine[21] report encouraging results from the use of a solution of quinine urea. At present, Stephan is carrying on a clinical study using zephiran and urea which is giving encouraging results. Recently, Fosdick[22] made mention of the local use of 2-methyl-1, 4-naphthoquinone (vita-

min K_4) to inhibit the production of acid from the degradation of carbohydrates by bacteria. Fosdick believes that it may be possible to prevent the development of caries if this agent is taken into the mouth immediately after eating. The method of application is to incorporate the 2-methyl-1, 4-napthoquinone in chewing gum. It should be pointed out that any action or effect of the compound in this regard is due to the antienzyme properties and not to an effect on the clotting time of the blood, such as that of vitamin K.

SUMMARY

What practical information then can we give the clinician for use in the control and treatment of dental caries?

1. It appears from almost every angle of approach that dental caries results from bacterial activity and that the chemicoparasitic theory announced by W. D. Miller half a century ago is in the main probably correct.

2. Further studies are needed before we can definitely state that the exciting agent is a certain micro-organism or organisms. Immunologic studies that offer considerable promise are under way.

3. The reports from the biochemists, bacteriologists and nutritionists all tend to support the statement that young children should be trained to develop normal food habits, especially in regard to enjoying all types of foods, and to regular hours for eating. Stephan's work indicating a rapid lowering of the pH on tooth surfaces following ingestion of sugar is sufficient to suggest that between meal "piecing" on cookies, cakes, candy, etc., is inadvisable. Certainly carbohydrates should not be consumed to the exclusion of a sufficient quantity of all other food factors.

4. Chemotherapeusis for the arrest or prevention of caries is still in the investigative stage and is therefore, at the present time, only of academic interest. Rapid strides are being made in this direction and undoubtedly we can expect considerable aid from these studies. The clinician should carefully follow all reports of this nature.

5. The statement by Stephan that, after a thorough brushing of the teeth, the characteristic drop in pH does not follow the application of glucose lends considerable weight to the importance of oral hygiene.

6. While it is freely admitted that it is impossible to free the mouth of bacterial flora, it is evident that it is necessary for the dental profession to engage in an intensive educational campaign for the general public regarding dental caries. The practitioner must take sufficient time to acquaint every patient with the importance of an adequate diet, regular eating habits and, by no means least, ways and means of thoroughly cleansing all tooth surfaces. We must do more than suggest to the patient that the mouth be brushed once or twice a day. We must teach all patients the technic of proper brushing, together with the technic of using floss through all contacts and over the distal surface of the posterior tooth.

If the clinician will use all of the information that we have at hand today, and see to it that his patients are sufficiently informed to give intelligent cooperation, it will be possible to reduce materially the incidence or rate of caries attack. With failure to meet the dental requirements playing such an important part in the rejection of thousands of selectees, it is imperative that we utilize every means at our command to inform the public as to ways and means of controlling caries. Education in the schoolroom, for civic and lay groups, and in our private offices is our only avenue of hope for the eradication of dental caries.

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EFFECT ON OCCLUSION OF UNCONTROLLED EXTRACTION OF FIRST PERMANENT MOLARS: PREVENTION AND TREATMENT

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THE sequelae of extraction of the first permanent molar, in the absence of subsequent orthodontic control of the direction, rate and amount of shifting of the adjacent and other remaining teeth in the dental arches, are well defined in adolescent boys and girls nearing the final stage of tooth development.[1] Although the loss of first permanent molars in children may occur as a result of neglected caries or accidents, purposeful extraction of first molar teeth is frequently resorted to as a therapeutic measure in an attempt to correct existing or impending malocclusion.

Data to be presented here and findings previously published[2] indicate that when the dentist fills a first permanent molar, not merely is a mechanical job done to preserve this important dental member, but also the incidence of decay of the entire mouth is favorably affected and the occlusal relationship of all the teeth in the jaws is preserved. Conversely, loss of teeth through decay and extraction tends to raise the incidence of dental decay for the mouth as a whole and bring about changes in the occlusion of the teeth.[3]

In dental examinations of more than 10,000 boys and girls from 15 to 19 years of age, pupils in the vocational schools of New York City, who had lost from one to all four of their first permanent molar teeth, the following dental changes were observed[4, 5]:

1. An increase in the incidence, frequency and rate of intensity of occurrence of "exteeth." "Exteeth" are teeth which have acquired some physical abnormality since the time of eruption; i.e., those teeth having fillings, those that had been extracted and those showing redecay or presenting any other clinical evidence of not being in the physical state that teeth usually are in at the time of eruption. Teeth that were malposed and hypoplastic or showed mottled enamel and other preeruptive abnormalities were not considered "exteeth."

2. A modification in the distribution of dental caries in the respective jaw quadrants, with an increase of "exteeth" in the maxillae over the mandible, regardless of the jaw in which the extraction occurred.

The rate of distal shifting of the first and second premolars was found to be the same in the majority of cases in the maxillae. Such differences as did occur in the maxillae tended to disappear as the interval after the first molar extraction increased. In the mandible, the rate of shifting of the first and second premolars was found to differ more frequently, and this difference persisted over a longer interval of time than in the maxillae.

The distal shift of the maxillary first and second premolars is accompanied by loss of interdental contact points, with insufficient separation of the teeth to allow food débris to be freely removed, as is usually the case in the mandible. If the

From the Dental Service of the New York City Vocational Schools.

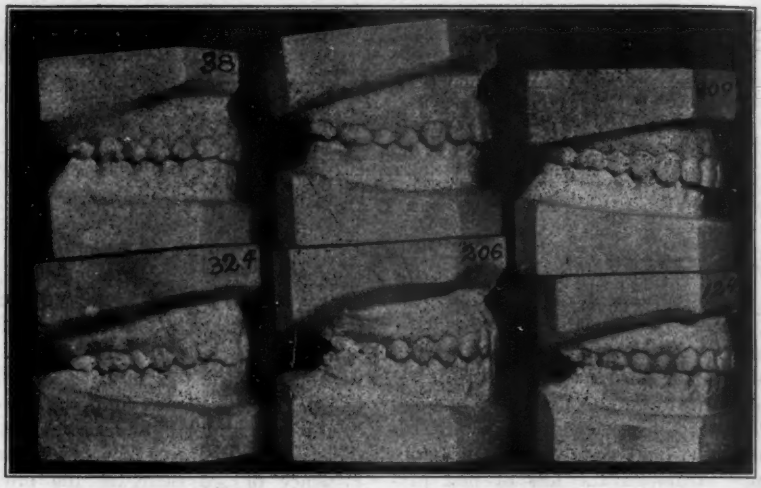

Fig. 1.—Casts showing normal occlusion with first molar present.

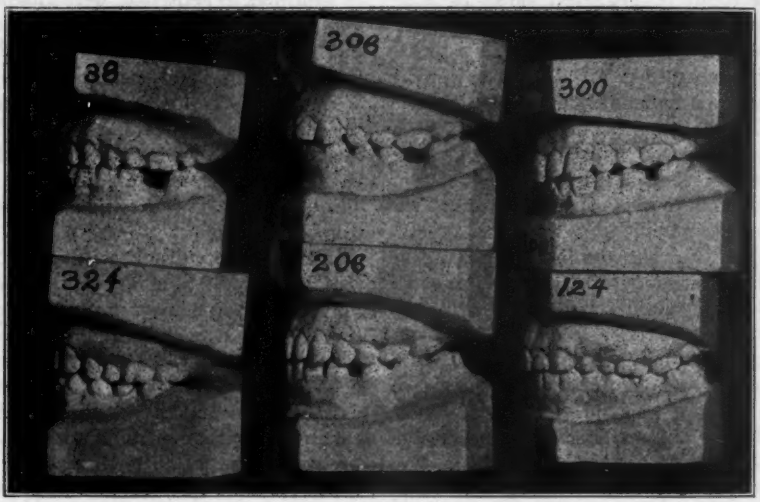

Fig. 2.—Opposite side of casts shown in Figure 1. A disturbance of the occlusion followed loss of the first molars. Casts 38 and 306 show different types of shifting of the premolars and second molar, and variation in the space left, although the interval since extraction of the first molar is the same in the two cases. Cast 300 shows the space from which the first molar has been extracted, still present after eight years. Cast 324 shows elimination of the first molar space in the lower jaw three years after the first molar was extracted. The occlusion of cast 324 is to be compared with that of the opposite side, shown in Figure 1. Cast 206 shows that the second premolar has erupted distally in the space left by extraction of the first molar when the patient was 9 years old and before the deciduous second molar was shed. Cast 124 shows closure of the space in the lower jaw, mostly due to the distal shifting of the teeth anteriorly from the extracted first molar.

mandibular first molar has been extracted, there is frequently also an elevation or continuous eruption of the opposing teeth and consequent loss of interdental contact points in the maxillary teeth. It may be assumed, therefore, that the increase in "exteeth" distribution in the maxillae in mouths from which first molars have been extracted is due to the difference in the rate of shifting between first and second premolars in the respective jaws, the loss of interdental contact and the increased tendency to food impaction in the maxillary jaw.

It is the intention to show here the general ill-effect on the occlusion of the teeth of promiscuous extraction of first molar teeth, without subsequent care to control the rate and direction of shift of

Fig. 3.—Above: Cast made at age 16. The mandibular right first molar had been extracted at age 15, the lower left first molar at age 10. Spacing and distal shifting of the premolars and mesial shifting of the second molar are beginning. On the left side, the first molar was extracted before the second premolar had erupted. The second premolar then erupted distally and occupied the space left by extraction of the first molar. The site of eruption of the second premolar and the type of space closure and tooth shifting of the adjacent teeth are influenced by the dental developmental stage at the time of extraction of the first molar.

Center: Cast made at age 16. The mandibular right and left first molars had been extracted at age 14. The distal shift of the first and second premolars and the mesial shift of the second molar are to be noted. The maxillary left first molar was extracted at 10 years, and the space closed completely, owing to lingual collapse of the lateral segment of the dental arch, placing the left maxillary premolars and the second molar in lingual occlusion.

Below: Cast made at age 17. The mandibular right first molar had been lost one year earlier. Closure of the space was due largely to the mesial shift of the second molar. The mandibular left first molar had been extracted at the age of 9. This space had closed. In the left maxilla, the root of the first molar had been retained, the forward shift of the second molar, which had become elongated, thus being retarded, and the mesial shift of the mandibular left second molar assisted. There is evidence of lingual collapse of the maxillary left lateral dental arch segment and a tendency to cross-bite where the cusps were shallow and the overbite was slight.

Fig. 4.—Occlusal views of casts in Figure 3.

Fig. 5.—Right side of casts with first molars extracted. The different types of distal shifting of the premolars and the mesial shifting of the second molar are evident in the various casts and the different sides of the same casts. (Compare Figure 6.) The type of shifting of the adjacent and other remaining teeth cannot be predicted.

the adjacent and the more remote teeth in the dental arches.

Table 1 shows that after the extraction of the first molar, the rate of distal shift of the first premolar is more frequently the same as that of the second premolar in the maxilla than in the mandible. Contrarily, in the mandible, the rate and amount of distal shifting between the first and second premolars after the extraction of the first molar vary more frequently than in the maxillae.

Table 2 shows that the variation in the rate of shifting of the first and second premolars persists longer in the mandible than in the maxillae, where the space

between the shifting premolars is gradually eliminated.

Table 3 shows five (1.0 per cent) of the 500 cases with one to all four first molars extracted, of which casts were obtained, with the remaining teeth in normal occlusal relationship. There were 184 cases (36.8 per cent) in Class I (Angle), or neutroclusion; 306 cases (61.2 per cent) in Class II (Angle), or distoclusion, and 5 cases (1.0 per cent) in Class III (Angle), or mesioclusion. This would indicate an unusually low number of cases in normal relationship and a rather inordinately high number of cases in Class II (Angle), or distoclusion, in children with from one to all four first molars extracted.

Since these cases were not seen before the first molars were extracted, an estimate of the probable occlusion before the first molars were extracted must be based on pure conjecture. However, such correlation as could be made indicated that 209 cases (41.8 per cent) had been in what can be termed normal occlusion; 156 cases (31.2 per cent), in Class I (Angle); 130 cases (26.0 per cent), in Class II (Angle), and five cases (1 per cent) in Class III (Angle).

After the first molars were extracted, cases in normal occlusion tended to become Class I and Class II malocclusion. Class I cases after extraction of the first molars either remained as Class I or changed to Class II subdivisions, while Class III cases showed a tendency to remain in the same classification as before the first molars were extracted.

Table 4 shows a comparison of the distribution of Class II cases after extraction of the first molars, with an estimate of the distribution before extraction. In the group having the first molars extracted, there were 306 cases; while the estimated number of Class II cases before any first molars were lost was only 130. The increase is apparently due to the number of normal and Class I (Angle) cases that changed into the Class II (Angle) category because of the shifting of the remaining teeth after the first molars had been extracted. The tendency of subdivision cases to increase, which was due to unilateral loss of the first molars, is also shown.

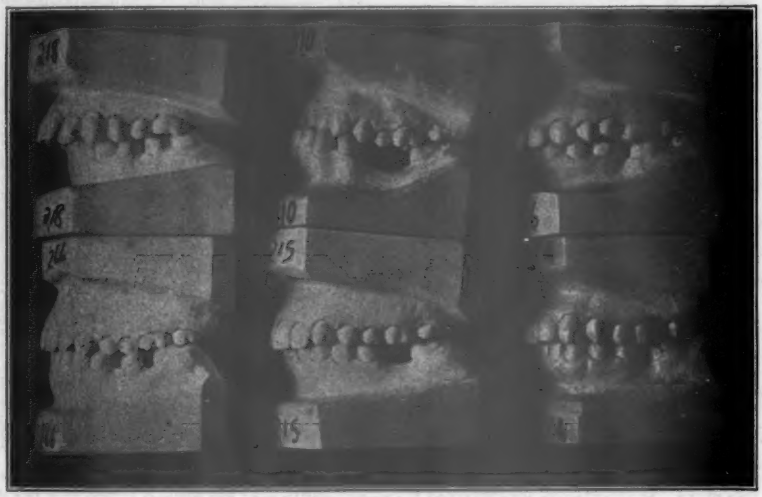

Fig. 6.—Left side of casts in Figure 5.

As the premolars adjacent to the space left by extraction of the first permanent molar shift distally, while the molar shifts in a mesial direction, there is a tendency for the median line of the teeth also to shift toward the side from which the first permanent molar was extracted. This shifting is followed by what is generally known as collapse, flattening or shortening of the arch on the side from which the first permanent molar has been extracted. Shortening occurs less frequently in the mandible, where there is usually an increase in the curvature of the line of occlusion (curve of Spee) toward the mandibular alveolar ridge, and an "elevation" or downward growth of the opposing maxillary teeth. The pattern of tooth shifting described here may be considered responsible for the intensification of caries in the mouth as a whole as well and for the tendency for the maxillary teeth to show more caries than the mandibular teeth. Furthermore, since the actual amount of mesial and distal shifting of the teeth is unpredictable, the promiscuous extraction of teeth is not a satisfactory therapeutic measure in orthodontics.

Fig. 7.—Above: Cast made at age 15. The maxillary right first molar had been extracted at the age of 12. Space closure was effected by mesial shifting of the second molar and the distal shifting and lingual collapse of the premolars. The lower right and left first molars were extracted at about age 11, before the second premolars had erupted. The second premolars erupted distally and occupied the space left by extraction of the mandibular first molars.

Center: Casts made at age 18. The maxillary right first molar had been extracted at 11 years. There is shifting of the median line to the right, due to distal shifting of the bicuspids and collapse of the upper right maxillary arch. The mandibular right and left first molars were extracted at 13 years, after the second premolars had erupted. The distal shift of the second premolars and the mesial shift of the second molars are evident.

Below: Casts made at the age of 17½ years. The mandibular right and left first molars had been extracted at the age of 13. The space was closed by shortening of the dental arch on the left and by creation of space anteriorly from the premolars on the right. The disturbance of the median line and the change in the curve of Spee are evident.

Restoration by orthodontic means of

the "collapse" or shortening of the arches resulting from loss of teeth is frequently necessary in order to restore the mesiodistal dimension before constructing satisfactory prosthetic appliances. The appliance to be used depends on the individual case.

Figure 7 shows malocclusion in an adult, aged 28 years, who had lost the mandibular right and left first molars, with subsequently uncontrolled shifting of the adjacent teeth. The mandibular incisors separated and were retracted lingually, the lower lip being brought under the maxillary incisors, which were thus stimulated to shift labially. The middle casts show the case after treatment. The casts on the right show the treated casts with the prosthetic appliance in position. The appliance used, a continuous clasp partial denture (Kennedy bar denture), is also shown. Treatment consisted in restoring the lost space and in correcting the inclination and rotation of the teeth adjacent to the extracted first molars and in correction of the maxillary and mandibular occlusal relationship in general. After the occlusion was restored, a Kennedy bar denture, which served also as a retaining

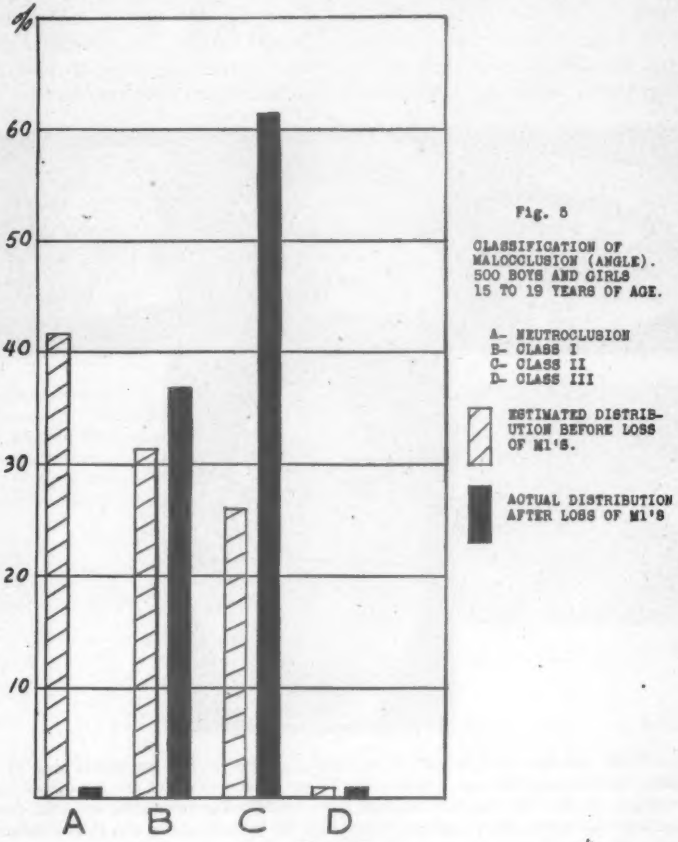

Figure 8.

appliance, was constructed by the patient's dentist.

CONCLUSIONS

1. Loss of first molars in mouths with normal occlusion, without subsequent control of the direction of shift of the adjacent and other remaining teeth in the jaw, leads to malocclusion.

2. Extraction of first molar teeth in mouths showing malocclusion, without control of the direction of shift of the remaining teeth, leads to aggravation rather than improvement of the existing malocclusion.

3. Since closure of the space after extraction of the first molars in the maxilla is due to a distal shift of the premolars, as well as a mesial shift of the second molars, loss of maxillary first molars in Class I (Angle) occlusion, because of the variation in the amount and direction of shifting, can cause such occlusion to change to Class II, Division 2, although the classification of the malocclusion in these cases usually remains the same. When mandibular first molars are lost in Class I (Angle) cases, Class II, Division 2 or a subdivision usually results, the condition depending on whether the loss of first molars is unilateral or bilateral, and on the relationship of the lower lip to the maxillary incisors, the biting strength and other local factors.

4. Loss of maxillary first molars in Class II (Angle) cases is not followed by self-correction because of the compara-

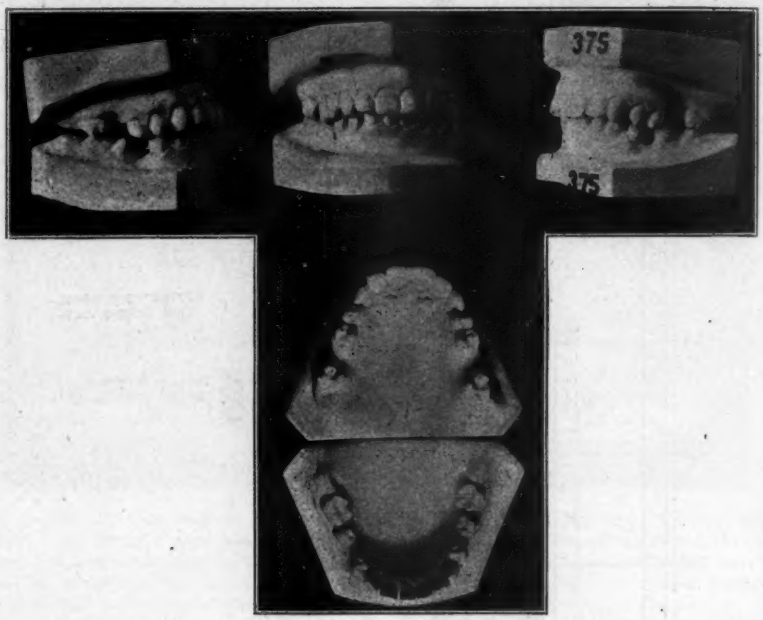

Fig. 9.—Casts showing all first molars extracted, at age 7. The patient is now 17. The first molar spaces in the maxilla have not closed. There is protrusion of the maxillary incisors and lingual collapse of the mandibular incisors. The mandibular premolars erupted distally. The first molar space between the second premolars and the second molar was thus eliminated by the development of a new space between the premolars. Extraction of the four first molars is not followed by the same type of space closure in all cases.

Fig. 10.—Casts and appliance in adult case showing malocclusion following extraction of mandibular first molars; condition after treatment.

TABLE 1.—PERCENTAGE OF CASES AND DIFFERENCE IN RATE OF DISTAL SHIFTING BETWEEN FIRST AND SECOND PREMOLARS IN UPPER AND LOWER JAWS AFTER EXTRACTION OF FIRST MOLARS*

Difference between First and Second Premolars Mm.	Percentage of Cases	
	Upper	Lower
None	56.3	37.4
1	32.1	35.8
2	9.4	14.3
3	1.0	6.0
4	0.3	1.2
5	0.7	2.7
6	0	0.9
7	0	0.9
8	0	0.45
9	0	0.15

*941 first molars in 500 children.

tively slight distal shift of the premolars and the relatively greater mesial shift of the adjacent second molars. Loss of the mandibular first molars in Class II (Angle) cases increases the relative pro-

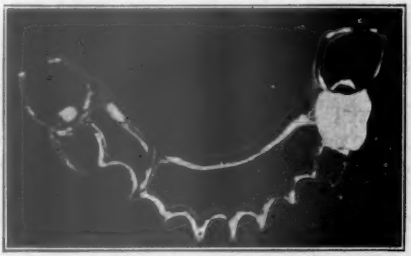

Fig. 11.—Appliance used in case shown in Figure 10.

traction of the maxillary incisors because of lingual collapse of the anterior teeth.

5. Loss of maxillary first molars in Class III (Angle) cases increases the malocclusion. Because of the tendency of mandibular premolars to shift singly, resulting in interdental spacing, in addition to other conditions present, extraction of mandibular first molars without subsequent treatment does not benefit Class III (Angle) cases.

6. It is shown here that uncontrolled shifting of teeth after extraction of per-

manent first molars cannot be relied on to correct crowding or other malocclusion of the teeth. In the few cases of improved occlusion, the improvement may be considered accidental or the result of other interference present in the mouth which did not permit the promiscuous shifting of the teeth, but allowed them to shift into a favorable position only.

TABLE 2.—WEIGHTED MEDIAN DIFFERENCE BETWEEN SHIFT OF FIRST AND SECOND PREMOLARS IN MAXILLA AND MANDIBLE AT DIFFERENT TIME-INTERVALS BETWEEN EXTRACTION OF FIRST MOLARS AND EXAMINATION FOR THE PRESENT STUDY*

Interval	Upper Mm.	Lower Mm.
3 mos.	0	0.23
6 mos.	0.7	0.52
1 year	0.8	0.85
2 years	0.6	0.98
3 years	0.7	1.3
4 years	0.6	1.4
5 years	0.5	1.3
6 years	0.5	1.9
7 years	0.5	1.4
8 years	0.47	1.8

*941 first molars in 500 children.

TABLE 3.—ANGLE CLASSIFICATION OF OCCLUSION OF 500 BOYS AND GIRLS FROM 15 TO 19 YEARS OF AGE WITH ONE TO ALL FOUR FIRST MOLARS EXTRACTED AS COMPARED TO ESTIMATED CLASSIFICATION BEFORE EXTRACTION AND SHIFTING OF THE TEETH

After Extraction			Before Extraction (Estimated)		
	No.	Per Cent		No.	Per Cent
Normal	5	1.0	Normal	209	41.8
Class I	184	36.8	Class I	156	31.2
Class II	306	61.2	Class II	130	26.0
Class III	5	1.0	Class III	5	1.0

TABLE 4.—DISTRIBUTION OF CLASS II (ANGLE) CASES IN VARIOUS DIVISIONS AND SUBDIVISIONS AFTER EXTRACTION OF FIRST MOLARS AS COMPARED TO ESTIMATED DISTRIBUTION BEFORE EXTRACTION.

	Classification Before Extraction (Estimated)		Classification After Extraction (Actual)	
	No.	Per Cent	No.	Per Cent
Class II Div. 1	41	31.53	59	19.3
Div. 1 (subdivision)	19	14.63	92	30.1
Div. 2	41	31.53	63	20.5
Div. 2 (subdivision)	29	22.31	92	30.1
Total	130	100.00	306	100.0

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654 Madison Avenue.

THE FIRST VALID D.D.S. DEGREES

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WHEN the late Lawrence Parmly Brown, in 1920, published his interesting and informative article entitled "New Light on Dental History,"[1] all of the evidence that is to be found in the pages of the *American Journal of Dental Science*[2] had not been given his consideration. Because of this fact, subsequent writers of textbooks on dental history, who, without checking the original sources, have transferred his statements to their pages in rewritten form, have erred in ascribing the automatic conferment of the degree of doctor of dental surgery with the diploma of the American Society of Dental Surgeons.

Thus, Taylor says:

> There can be no doubt that membership in the Society in its earliest years automatically conferred this degree regardless of the diploma. . . . It appears that members were only admitted to this society and diplomas granted them after a most thorough examination to test the qualifications of the practitioner.[3]

Lufkin writes:

> Membership in this society automatically conferred the degree of Doctor of Dental Surgery and was limited to those who qualified by properly passing an examination. No degrees were issued by the society after 1843, in deference to the Baltimore College.[4]

Recently, in the Proceedings of the Dental Centenary Celebration, Robinson tells us of Hayden that his D.D.S. was "conferred by the American Society of Dental Surgeons under the authority provided by its bylaws,"[5] and that Harris "secured his D.D.S. degree automatically by his membership in the American Society of Dental Surgeons."[5]

L. P. Brown's statements, upon which the foregoing excerpts are based, are as follows:

> . . . it [the D.D.S. degree] attained professional status when it was conferred for the first time in history, by the American Society of Dental Surgery [sic] at its first convention, August 1840, some seven months before the [Baltimore] college conferred it at its first commencement, March 9, 1841. . . .[1]
>
> This diploma [of the Society] doubtless conferred the degree of Doctor of Dental Surgery; for surely Hayden and Harris would not have put the D.D.S. to their names on the college diplomas of 1842, and later, if the Society had previously abandoned its original intention of conferring the degree.[1]

It was unquestionably the "original intention" of the founders of the society that their organization should be empowered to bestow this degree upon its members. In the bylaws, adopted August 19, 1840, it is stated that one of the duties of the president is "to confer all honorary distinctions awarded by the Society, whether Degrees of Dental Surgery, medals, or other testimonials,"[6] and that "the Recording Secretary shall . . . keep the seal of the Society, together with the copper-plate, from which diplomas, certificates, or degrees, are struck."[6] Provision was made for an examination of candidates for membership by an examining committee, of whom it was said that "their certificate shall entitle the holder to receive the diploma of the Society conferring the

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degree of Doctor of Dental Surgery."[6] Furthermore, it was said that among the privileges of acting members or fellows, they are "entitled to a Diploma, or Degree of Doctor of Dental Surgery,"[7] and of honorary members that they "shall receive the Diploma, or Degree of Doctor of Dental Surgery."[7]

But just as it was clearly their intention to have this privilege vested in their society, this little group of intelligent men understood very well the necessity of obtaining a charter from a sovereign political entity, granting them this power. Many of these men had been active in the Society of Surgeon Dentists of the City and State of New York, which preceded the American Society of Dental Surgeons, with which, in a sense, it merged.[1] The preamble to the constitution of this New York organization stated ". . . we will petition the Legislature of the State of New York for a charter, conferring the privilege . . . of granting diplomas. . . ."[7] Similarly, we find that immediately after the adoption of their own first constitution and bylaws, in 1840, the nascent American Society of Dental Surgeons passed a resolution "That: Eleazar Parmly, M.D., be appointed as Agent of this Society, to present a petition to the Legislature of the State of New York, asking for a Charter, with power of conferring the degree of Doctor of Dental Surgery."[8]

It would hardly be possible to state their understanding of their own limitations more definitely than this.

The reason for the desire of the members of this group to obtain the degree-granting privilege at this time was their concern for the well-being of the emerging profession of dentistry and of the public to which its services were offered. Their aims were highly ethical. The Baltimore College was as yet in the process of being established. In almost all the states, the practice of dentistry was in the hands of whosoever desired to hang out his shingle; and, as William H. Trueman[9] has said, it was the hope of the members of the society that they could establish standards, and issue certificates, that would be safe criteria for prospective dental patients. For this reason, their bylaws provided that their examining committee should " . . . appoint a time and place, at least once in each year, for the examination of applicants (apprentices of two years standing) for the Degree of Doctor of Dental Surgery; to examine such persons strictly and faithfully, in relation to their qualifications to enter upon the practice of their profession."[10] In addition to this type of applicant, there were established practitioners, whose reputation had to be completely satisfactory. Holders of "the diploma of any Dental College, regularly chartered in any of the United States," were admitted without examination.[11]

The general aims of the society were quite widely and favorably commented upon, and note was made both in the United States and in England of its desire to acquire the degree-giving power. Referring back to excerpts in the *American Journal of Dental Surgery,* we find that the *Boston Medical and Surgical Journal,* October 21, 1840, remarked upon the society's application to the New York Legislature for such a charter[12]; and a letter in the London *Lancet,* of July 17, 1841, speaks of the "many . . . laudable designs [of the Society, among which is] ultimately the conferring of a degree in dental surgery on properly qualified candidates."[13]

At Albany, however, the affairs of the society were not prospering. Notwithstanding this fact, Solyman Brown, the recording secretary, wrote optimistically, early in 1841:

> By the time of the second annual meeting, in August next, much progress will be made towards bringing the association into regular form, provided the Agent appointed

to make application for a charter to the Legislature of the State of New York, at its ensuing session, shall meet with desired success. Indeed, so few and so reasonable are the powers and privileges requested in this charter that the success of the application is hardly problematical. By the period above, mentioned, the Diploma will be ready for its seal, signature, and distribution.[14]

The Baltimore College of Dental Surgery held its first commencement March 9, 1841, and, in August of the same year, the society held its second annual convention, in Philadelphia. It had not yet received the desired charter.

Unfortunately, we do not have access to the original minutes of the society, and the editors of the *American Journal of Dental Science* (our principal source) candidly state that "in publishing other parts of the proceedings of the Society, we shall extract from the minutes such portions only as we deem of general interest to the profession."[15] What was said or done at the third annual convention, held in Boston, in July 1842, in respect to the charter, we do not know. A motion was passed, however, to establish a permanent meeting place, and New York City was chosen over Philadelphia by a margin of eight votes.[16]

Notwithstanding this decision, the next, or fourth, annual convention was held in Baltimore, in July 1843, by the still charterless society, which now "resolved that Drs. E. Parmly, S. Brown, and E. Baker be continued a committee to prepare a memorial to the Legislature of the State of New York, asking for a charter of this Society, and to hold property."[17] But the legislature, if it actually was petitioned in the matter, remained obdurate. L. P. Brown,[1] corroborating the previous findings of William H. Trueman,[9] states that "there is no record at Albany that the Society was ever chartered or incorporated by either the Legislature or Secretary of State."

In the meanwhile, there must have been considerable discussion on the subject of the alleged degree-conferring powers of the society, enough to call forth an editorial in the *American Journal of Dental Science*. This was written by Edward Maynard, who, with Harris and Brown, was at the time serving as one of the principal editors.[18] The importance of Maynard has recently been emphasized in a biographical study by William D. Hodgkin.[19] Maynard, an original member of the society, had been appointed to the Committee on Seals, Diplomas, Etc.,[20] and, being endowed with rare artistic ability, had himself designed the official insignia of the society.[21] He also took a foremost part in the other affairs of the organization, and, in 1842, was elected to its executive committee, in whose activities he was one of the most prominent figures.[22] No other member of the society was so favorably situated in knowledge of its intentions, the significance of the wording of its diploma or the state of its affairs, when he published the following statement:

> We perceive, with regret, that some of the members of the American Society of Dental Surgeons have mistaken the language of the Society's Diploma, supposing it conferred the degree of doctor of dental surgery. Such are informed that the Society has not yet the power (being yet unchartered,) to confer *any* degree, its diploma being a certificate of membership only. The Baltimore College of Dental Surgery is the only institution having the authority to confer the degree of D.D.S.[23]

About the time that the editorial just quoted was written, the society adopted a revised constitution and bylaws, in[24] which, although there is reference to the possibility of conferring honorary D.D.S. degrees, there is no statement of any kind relative to the conferring of any degree whatsoever with the diploma of active membership. The idea was definitely abandoned, and with it the previously adopted decision to have the annual meeting place fixed in New York City.[25]

If any further attempt was made to obtain a charter from the state legislature, it was not noted in the available records.

So much for the "automatic" conferring of the degree of doctor of dental surgery with the diploma of the American Society of Dental Surgery. It is perhaps of minor importance to note that this was not the only dental organization which entertained such an idea. In 1843, the Virginia Society of Dental Surgeons organized and applied for a charter for the purpose of examining candidates for license to practice,[26] and in the transactions of its first annual meeting, held in October 1843, it is stated that "the Examining Committee reported to the Society the name of Solomon Angle, who had been rigidly examined on the theory and practice of Dental Surgery, and who they recommended to membership in the Society, and to the degree of D.D.S."[27] Both Hayden and Harris were created honorary members of this society at the same meeting, and were furnished with the Society's diploma, without fee. We do not find, however, any "automatic" validity in any of these alleged D.D.S. degrees, and it is not until after the charter was granted by the Virginia Legislature, in 1845, that such degrees as were subsequently awarded had a secure and legal basis.[28]

On the other side of the mountains, the Mississippi Valley Association of Dental Surgeons was organized in Cincinnati, in August 1844.[29] Its subsequent history shows that it learned from the experience of its members who were also members of the American Society of Dental Surgeons; for, probably in view of the operation of the Baltimore College of Dental Surgery and of the pending establishment of the Ohio College of Dental Surgery,[30] no degree was offered with its certificate of membership.[31] Parenthetically, another lesson that they learned was to keep out of the then raging "Amalgam War," in which the American Society of Dental Surgeons was slowly, but inevitably being consumed.

The second essential part of L. P. Brown's assumption of validity for the D.D.S. degree of the American Society is contained in his statement already quoted, that "surely Hayden and Harris would not have put the D.D.S. to their names on the College diplomas of 1842, and later, if the Society had previously abandoned its original intention of conferring the degree."[1]

We have already shown the fate of this "original intention": it failed of fruition and withered away. But, during the first two or three years of the existence of the society, the enthusiasm of its founders was tremendous, and the others very possibly felt, as Solyman Brown did, that their early success in obtaining this authority was "hardly problematical."[13] If assumptions are in order, we can assume that they were so certain of obtaining their charter that their use of the D.D.S. degree seemed not only valid, but also almost legal to them. They were strong-minded men, and very sure of themselves.

Furthermore, although knowledge was had of the proprieties in the conferring and use of degrees, this knowledge was not observed with punctilio, even by Hayden and Harris. During the period of 1839-1841, in the first volume of the *American Journal of Dental Science*, Hayden is inscribed as Horace H. Hayden, Esq.,[32] and as Horace H. Hayden, M.D.[33] In the same volume Harris is variously inscribed as M.D., Surgeon Dentist[34]; as Dr. Harris[35]; as Chapin A. Harris, M.D.,[29] and as Chapin A. Harris, M.D., D.D.S.[49] These vagaries are carried on in the succeeding volumes.

J. Ben Robinson recently made a study of the degrees and licenses received by these two men, and his findings may be presented as follows[5]:

Horace H. Hayden:

1810: Granted a license to practice dentistry under the authority of the Medical and Chirurgical Faculty of Maryland, which carried with it membership in that pioneer medical society.

1837: Honorary M.D., Jefferson Medical College of Philadelphia.

1840: Honorary M.D., University of Maryland.

D.D.S. conferred by the American Society of Dental Surgeons under the authority provided by its bylaws.

Chapin A. Harris:

1824, Circa: Licensed to practice medicine in Ohio.

1833: Licensed to practice dentistry in Maryland under the authority of the Medical and Chirurgical Faculty.

Secured his D.D.S. degree automatically by his membership in the American Society of Dental Surgeons.

1854: It is said that he received an honorary D.D.S. from the Philadelphia Dental College.

Robinson further makes the important contribution that "there is reasonable justification (after study of available facts), [for the statement] that when Harris was licensed in Ohio, he assumed the M.D. degree and continued to use it."[5]

Hayden, as is well known, died in 1844, but Harris, a much younger man, continued his active, useful, superlatively productive life. To add to his already full score, in 1849 he produced the first edition of his dental dictionary. We feel that next to the last word on the validity of the D.D.S. degree as used by these two giants of dentistry can be said best by L. P. Brown, from whose article "New Light on Dental History" we once more quote:

> Harris, in the first edition of his Dictionary of Dental Surgery, defines the term "Doctor" as "a title properly confined to one who has received from a regularly *chartered* institution or college the degree of doctor of medicine or doctor of dental surgery. The power of conferring the latter degree was first invested in the Baltimore College of Dental Surgery by the Legislature of the State of Maryland, by an act of incorporation granted in 1840." *But nevertheless we find "Chapin A. Harris, M.D., D.D.S.," on the title page.*[1]

Perhaps the final word of this part of our critique can be left to Kipling:

> When 'Omer struck 'is blooming lyre,
> He'd 'eard men sing by land an' sea;
> An' what 'e thought 'e might require
> 'E went and took—the same as me.

The first graduates from the Baltimore College of Dental Surgery received their diplomas March 9, 1841. We know that there were two of them, Robert Arthur and R. Covington Mackall. They share equally the distinction of having had conferred upon them the first valid degrees of doctor of dental surgery. It is assumed by all the dental historians who touch upon this subject that Arthur, by virtue of his strategic alphabetical position, received his diploma in the physical sense before Mackall. Yet Thomas E. Bond, Jr., their dean, lists their names in the reverse order.[3?] It may be that the local newspapers of the period will be found to contain a sufficiently detailed description of the graduation ceremonies to settle this matter, and upon further examination of these or other sources, we shall resolve the question.

SUMMARY

Evidence is presented that the so-called degrees of doctor of dental surgery allegedly conferred by the American Society of Dental Surgeons were invalid, and that the first valid degrees of doctor of dental surgery were conferred by the Faculty of the Baltimore College of Dental Surgery in 1841.

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ACUTE HERPETIC GINGIVOSTOMATITIS: REPORT OF FIFTEEN CASES

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IN 1938, the term "acute infectious gingivostomatitis" was given by Black[1] to an oral disease found chiefly in early childhood. The infection was characterized by marked gingivitis, oral fetor, fever and enlargement of the regional lymph nodes. It occurred most commonly in the fall and winter months and was mildly contagious. It was benign and self-limited, and recurrences were rare. Previously, this condition had been considered a form of Vincent's stomatitis. Black, however, in reviewing the problems of etiology, suggested that fusospirochetal organisms played a subordinate rôle in the pathogenesis and that although the cause was unknown, the primary infective agent might be a virus.

At about the same time, Dodd, Johnston and Buddingh[2] reported a series of eighty-eight cases of a type of stomatitis common in childhood and usually called aphthous stomatitis. Twelve of these cases were tested for the presence of the herpes virus by scarification of a rabbit cornea with material from the oral lesions. In each instance, a typical herpetic keratoconjunctivitis was produced with acidophilic intranuclear inclusion bodies present in the infected cornea. Furthermore, the inoculated rabbits, after recovery, were immune to a second inoculation with a known virulent strain of the herpes virus. As the majority of cases occurred in children, these investigators thought the disease represented a primary infection with the virus of herpes simplex, and called it herpetic stomatitis.

Confirmation of this idea appeared to come from the observations of Burnet and Williams[3] in 1939. They concluded that herpes labialis was a recurrence of the primary herpes simplex infection seen in childhood. They believed that once the infection had been acquired, the virus appeared to remain latent in certain cells throughout life. Recurrences, manifested by the appearance of herpes blisters, had as their stimuli vaccine therapy, pyrexia, colds, etc. These authors derived the evidence for their statements from serologic studies demonstrating the development, as a result of the disease, of antibodies against the virus. Second attacks were seen in persons whose serum contained antibodies; whereas, during primary infections, no neutralizing antibodies were present. From these studies, it was concluded that 90 per cent of the population in Melbourne harbored herpes virus.

Two years later, in 1941, Scott, Steigman and Convey[4] reported a group of twenty-one cases of primary herpetic stomatitis. The contagious nature of the disease in this series was indicated by a history of contact in about 50 per cent of the cases. When no direct contact with a case of stomatitis or any herpetic lesion was found, the possibility of "healthy carriers" was investigated. Of nine moth-

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HERPETIC GINGIVOSTOMATITIS CASES

Case	Age in Years	Sex	Race*	Oral Involvement: Alveolar Gingivae	Mucous Membranes	Ulcers	Pain	Herpes Labialis	Fever	Lymph Adenopathy	Duration in Days	Rabbit Test: Keratoconjunctivitis Day	Encephalitis Day	Recovery Day	Intracerebral Test	Treatment
1	7	♂	B	+++†	+	++	++	+	+	+	7	4th	9th	11th	Neg.	Drugs
2	11	♂	W	+++	+	+	+	−	+	+	11	6th		12th	Neg.	Drugs
3	7	♀	W	+++	+	−	++	−	+	+	11					Drugs
4	6	♀	B	+++	+	−	±	−	+	+	8	4th		15th	Neg.	Drugs
5	7	♀	B	+++	+	−	+	−	+	+	4	7th		15th	Neg.	Drugs
6	10	♂	B	−	−	+++	+	+	−	−	6					None
7	11	♂	B	+++	+	++	+	+	+	+	6					Drugs
8	34	♀	W	−	+	++	++++	−	+	+	5	3rd		11th	Neg.	Pituitrin
9	32	♀	B	+	+	++	++++	+	+	+	3	3rd		9th	Neg.	X-rays & pituitrin
10	21	♀	W	+++	+	++	++++	+	+	+	10	3rd		15th	Neg.	X-rays
11	22	♂	W	++	+	+	+	+	−	−	3	4th	5th	died		Drugs
12	25	♀	W	−	−	−	++++	++++	+	+	10					Drugs
13	22	♀	W	+++	+	−	++	−	−	+	8	not	made			Drugs
14	31	♂	W	+++	−	−	++	+	+	+	5	not	made			Drugs
15	25	♂	W	+++	+	−	++	+	+	+	7	not	made			Drugs

*B, black; W, white.
†± to ++++, degree of involvement; −, no finding.

ers tested, all had strong neutralizing antibodies in their serum. Herpes virus, however, was, on two occasions, demonstrated in the saliva. From these observations, the authors concluded that, without any evidence of oral involvement, a woman may possibly provide a focus of infection for her susceptible children.

In a recent paper, Black[5] presents additional evidence for herpes virus as the etiologic agent of acute infectious gingivostomatitis. Inoculation of the gum of a 1-year-old child, with fluid from a herpes vesicle, was followed by the development of an illness typical of acute infectious gingivostomatitis. The inoculated child showed no antibodies for neutralizing the herpes virus before this inoculation, but after recovery had an immunity and was also refractory to oral inoculation with a known virulent strain of the virus. The virus, absent from the mouth before the original inoculation, was recovered during the illness and for two weeks after complete clinical recovery, but was absent about a week later.

Fig. 1 (Case 3).—Herpes labialis.

The present report is based on a study of a group of children referred through the courtesy of Rustin McIntosh, of Babies Hospital, and patients from other divisions of the medical center. The results are tabulated in the accompanying table.

Cases of adults with primary lesions have received scant consideration in the literature. The series here presented consists of seven in children and eight in adults, all with herpetic or gingival lesions. All except three were tested for the presence of herpes virus. Symptoms of the primary infection are the same in children and adults.

The ages of patients ranged from 6 to 34 years. There were seven males and eight females; six black and nine white. The general complaint was sore mouth and/or sore throat. The young children refused food on the ground that swallowing was difficult. Other complaints were: bleeding, swelling of the gums, oral fetor, fever and malaise.

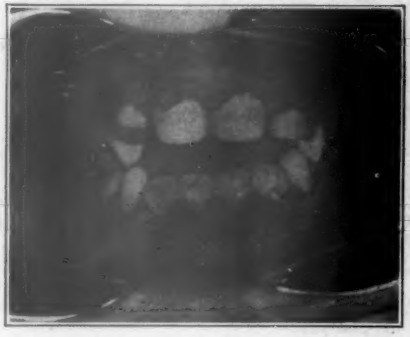

Fig. 2 (Case 3).—Deep red marginal gingivae, which were hypertrophic and spongy.

Frequently, the first sign of the infection is a herpetic lesion (herpes labialis) on the lips. (Figs. 1 and 2.) Vesicles may appear anywhere on keratinized gums or mucous membranes or in the throat. (Fig. 3.) Vesicles may appear on the skin or mucous membranes. The free gum margin and interdental papillae are also involved. (Figs. 4 and 5.) The alveolar gingivae are spongy and swollen crownward, the condition tending to bury the teeth. (Fig. 6.) The regional

lymph nodes are invariably swollen and tender.

The most common site is the region of the anterior teeth and gingival flaps over erupting molar teeth. Usually, the entire alveolar gingivae is involved, although occasionally the gums are not affected. (Fig. 3.)

Vesicles may appear over the entire pharynx and the mucous membranes of the lips, cheek and tongue. The vesicles in the mouth are discrete, small and round and of pinhead size. They burst and leave shallow crater-like ulcers, usually covered with a yellowish exudate and having inflamed borders. At times, they coalesce.

The gums take on a deep redness. In some instances, a fiery red line is seen at the gingival margin. (Figs. 7 and 8.)

Fig. 3 (Case 6).—Uninvolved gingivae. There were herpetic vesicles on the upper lip and aphthous ulcers on the lower lip and in the pharynx.

This intensely red line is characteristic. The onset is insidious in about one-third of the cases, and is coincidental with upper respiratory infections. In most cases, it is acute. Fever ranging from 99 to 105° F. (rectal) lasts for a few days. The average temperature is 101° F. Malaise and irritability are present for a few days, accompanied by lymphadenopathy. The appearance of vesicles in the mouth follows the acute systemic symptoms. The course in general is stormy.

Recurrences are uncommon, and usually not so severe as the original attack. Exceptions to this general finding were seen in two cases (one child and one adult) not included in the fifteen under discussion, in which recurrences were noted several times during the period of a year, all equally severe. Sometimes the disease recurs in the same location.

The disease runs its course in from one to three weeks, usually about two and one-half weeks. The mouth ulcers heal in five or six days. The herpetic lesions on the lips and the lymphadenopathy may last from five to six weeks. In appearance and duration, they are suggestive of primary syphilis; but two such cases tested for syphilis were found to be negative.

In most instances, the pain is more annoying than severe. In a few, it is

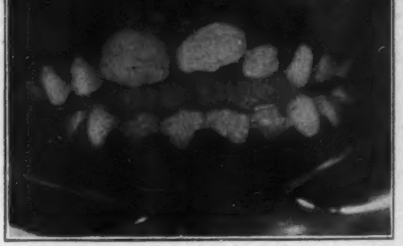

Fig. 4 (Case 1).—Hypertrophic, spongy and highly inflamed gingivae, treated with 2 per cent solution of gentian violet daily.

intense. In one of our adult cases, the pain from the presence of vesicles on the hard palate was typical of herpes zoster. The rabbit test, however, was positive for herpes simplex. In another case, the pain was typical of major tic douloureux. Here too, the rabbit test was positive. (Figs. 9 and 10.) When molar flaps are swollen and traumatized, the severe pain may be characteristic of Vincent's infection.

Both clinic and private patients are affected. The higher incidence in clinic patients may be due to better opportunities for contagion. Nutritional factors

could not be established as predisposing.

The virus of herpes simplex was established as the cause of the primary infection—acute infectious herpetic gingivostomatitis—in the following manner:

As the virus usually disappears with the healing of the lesions, saliva was taken, where possible, during the acute stage of the disease. The material to be tested was swabbed on one scarified anesthetized cornea of a rabbit's eye, while the scarified uninoculated eye served as a control. If herpes virus was present in the saliva, a slight cloudiness of the corneal surface appeared in the inoculated eye in from twenty-four to forty-eight hours. Close inspection revealed numerous small focal swellings, followed during the next few days by an acute purulent conjunctivitis. (Fig. 9.)

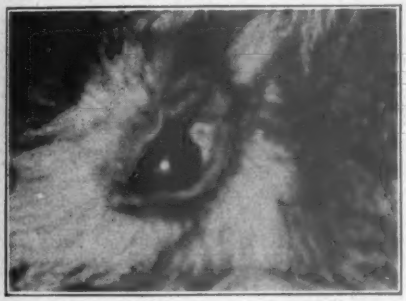

Fig. 5 (Case 1).—Keratoconjunctivitis produced in rabbit by swabbing scarified cornea with patient's saliva.

The inflammation subsided in two or three days, leaving a variable degree of damage to the cornea. The control eye appeared normal at all times. (Fig. 10.) In a few instances, the virus reached the central nervous system and produced a fatal herpetic encephalitis. Usually, the rabbits recovered and were resistant to intracerebral injection with a known strain of herpes virus. Furthermore, the serum from these animals contained virus neutralizing antibodies. In several instances, pus from the eyes was found to be sterile at the height of the infection. However, when rabbits or mice were inoculated intracerebrally with this pus, a fatal encephalitis resulted, showing the presence of the virus. The brains from these animals also contained the virus, but no bacteria, and the infection could easily be transferred by brain inoculation from animal to animal.

CONTAGION

The contagious nature of herpes simplex is evidenced by the fact that more than half of our cases gave a positive history of contact (herpetic sores on lips). (Figs. 11-12-13.) This is in close agreement with Black's findings of 47 per cent. There were several instances of more than one child in a family being affected.

Fig. 6 (Case 2).—Gums partially covering crowns of teeth.

Additional evidence is found in the report of Goodpasture,[6] who states that the herpes virus is not a normal inhabitant of rabbits. Yet normal rabbits readily contract herpetic encephalitis when placed in the same cages with rabbits inoculated on the cornea with herpes simplex virus. The virus is not found in the mouths of children.

The endemic nature of the affection is suggested by the fact that most of our cases came from a limited geographic area, and occurred during October, November and December, although occurrences are not confined to epidemic periods. The widespread antibody forma-

tion among the population is evidenced by the presence of herpes neutralizing antibodies in the serum of from 65 to 90 per cent of adults. [5, 7]

Most reported studies point to the probability that the disease is contagious. From what has been said, it is evident that herpes virus may be spread from case to case in saliva or droplets of oral secretion. Infection, therefore, may be either by direct contact or indirect by the use of infected cups, spoons, etc.

In ninety-five samples of healthy saliva,[8] we were unable to isolate the virus of herpes. It has been noted that occasionally a patient who has recovered carries the virus in the saliva for some time after all clinical evidence of the disease has disappeared.[4, 9] If, however, the virus remains latent somewhere in the tissues after a primary attack, and is only activated under certain conditions, the infection is probably endogenous in the great majority of cases, although Burnet and Williams[3] believe it to be both endogenous and exogenous.

Fig. 7 (Case 4).—Cyanotic appearing gums partially covering crowns of teeth.

Sometimes, acute herpetic gingivostomatitis is followed by Vincent's infection as a complication. In such instances, the infection is more resistant to treatment than ordinarily.

DIFFERENTIAL DIAGNOSIS

Herpes Zoster—This condition and herpes gingivostomatitis have certain symptoms in common. In some of our cases, the extreme pain characteristic of herpes zoster was present. The rabbit tests were positive; i.e., contraindicative of herpes zoster.

Tic Douloureux.—Clinically, tic douloureux is recognized by frequent flashes of excruciating pain which last for about ten seconds and may be set off by manipulation of a trigger zone. In some cases of herpes simplex, this pain and trigger zone are present. When the characteristic pain is brought on by manipulation of the trigger zone, there are no lapses of time between flashes. In other words, continuous manipulation causes continuous pain; whereas, in tic douloureux, continuous manipulation brings on pain only at intervals. Two of our cases gave such symptoms.

Fig. 8 (Case 4).—Keratoconjunctivitis produced in rabbit.

Vincent's Infection.—Herpes stomatitis is most commonly mistaken and treated for Vincent's infection. Because the disease is self-limited, anti-Vincent's treatment is considered successful. It may be differentiated by: (1) occurrence in children; (2) lack of necrosis at the crest of interdental papillae and pseudomembrane formation; (3) lack of intense pain in most instances; (4) a negative Vincent's smear for the fusospirochetal group of organisms. However, smears that are positive for Vincent's organisms are so often found in conditions not "Vincent's" that the smear technic, though commonly relied upon,

has virtually no value in differential diagnosis. For control purposes, we tested two cases of Vincent's infection for the herpes virus, using rabbits. The results were negative.

Herpes Labialis.—The common cold sore, while caused by the presence of the herpes simplex virus, when unaccompanied by the other symptoms enumerated here, is probably endogenous, arising from such secondary conditions as colds, vaccine injections, artificial fever therapy, long exposure to sun and traumatization. It is related to herpetic gingivostomatitis and is usually a concomitant when the primary infection is present. In the absence of the systemic signs mentioned, it may be considered as probably indicative of a recurrence having different clinical manifestations and connotations.

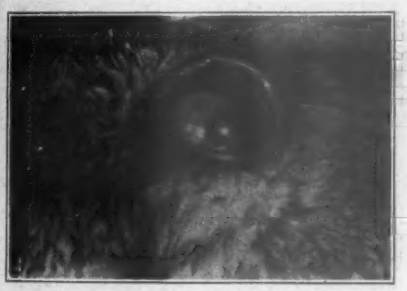

Fig. 9 (Case 9).—Keratoconjunctivitis and vesicle formation in scarified eye of rabbit produced by swabbing with patient's saliva.

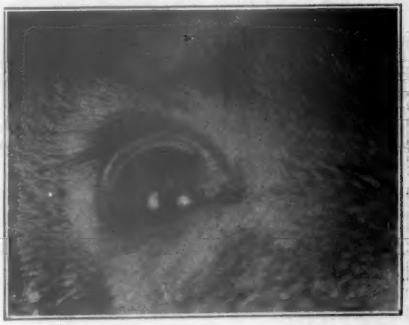

Fig. 10 (Case 9).—Scarified control eye in rabbit test.

RECURRENT APHTHOUS ULCERS

As has already been stated, aphthous ulcers are generally present in primary herpetic stomatitis, and are again seen in recurrences. Frequently, confusion exists between the latter manifestation and a form of recurrent aphthous ulcer which, as far as is known, is unrelated to herpetic stomatitis. The features which distinguish these two types are as follows: 1. In acute herpetic gingivostomatitis, the ulcers may appear anywhere on the mucous membranes, while the other aphthae referred to are seen, as a rule, only on the unkeratinized mucous membranes. 2. In herpes, the ulcers are often yellowish and transient; whereas other lesions of recurrent aphthae assume a grayish tinge and old crops are replaced by new so that their presence is almost constant. 3. The duration of herpetic symptoms is ordinarily from one to three weeks as compared with several months or even years in the other form. We tested four cases of recurrent aphthous or traumatic ulcers[10] for the herpes virus, using the rabbit's cornea. The results were negative.

TREATMENT

Since the disease is self-limiting, medication is not essential. Good hygiene and daily topical applications of 2 per cent gentian violet are aids, and are often effective in preventing a complicating Vincent's infection.

In adult cases accompanied by severe pain, we tried pituitrin, an agent advocated by Somers and Pouppirt[11] in the treatment of herpes zoster. We found this method effective in some degree.

X-ray treatment, recommended by McCombs, Tuggle and Guion,[12] was tried in two adult cases with good results.

Vitamin B was found to be of questionable value.[13]

Vaccines,[14] both formalized and autog-

enous, were tried without significant results.

In evaluating our experiments in the treatment of acute infectious gingivostomatitis, there have been too few cases available for definite conclusions.

REPORT OF CASES

Case 3 (Figs. 1 and 2).—A girl, aged 7, white, complained of soreness of the gums, with slight bleeding on traumatization, pain on swallowing, slight trismus and loss of appetite, of eleven days' duration. The temperature was 102° F. There was a herpetic vesicle on the lip (Fig. 1) and the submaxillary glands were swollen. The entire mucosa, including that of the throat, was inflamed. The marginal gingivae were hypertrophic and spongy, and were a deep red.

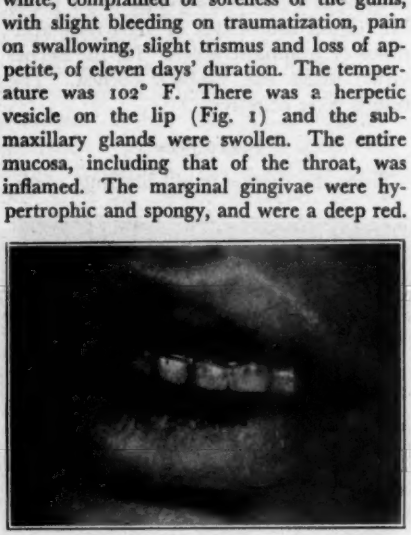

Fig. 11 (Case 10).—Herpetic lesion on lip.

(Fig. 2.) A rabbit test gave a questionably positive result. The gums were painted with a watery solution of gentian violet daily for two weeks. The patient was confined to bed until the temperature was normal. The condition was improved after two weeks.

Case 6 (Fig. 3).—A boy, aged 10, colored, complained of sore throat and lips. There were herpetic vesicles on the upper lip and aphthous ulcers on the lower lip and in the pharynx, of six days' duration. There was a herpetic sore on the leg. The gingivae were not involved. Results of a rabbit test were negative. No treatment was given.

Case 1 (Figs. 4 and 5).—A boy, aged 7, colored, complained of pain, swelling and bleeding of the gums of seven days' duration, with fever and malaise. There were aphthous ulcers on the mucous membranes of the lower lip and in the mucobuccal fold. The entire gingiva was hypertrophic, spongy and highly inflamed. There was an intensely red line at the gingival margins. Results of a rabbit test were positive. The gums were painted with a 2 per cent solution of gentian violet daily. (Fig. 4.) Figure 5 shows the keratoconjunctivitis produced in the rabbit's eye by swabbing a scarified cornea with a swab dipped in the patient's saliva.

Case 2 (Fig. 6.)—A boy, aged 11, white, a brother of the patient in Case 3, complained of pain and bleeding of the gums, especially on mastication, with loss of appetite, fetid breath, fever and malaise. The gums were greatly swollen, covering in part the crowns of the teeth. The margins were bright red, while the alveolar gingivae

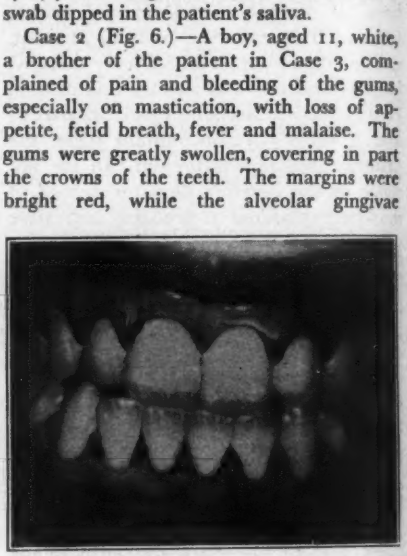

Fig. 12 (Case 10).—Swollen, inflamed gums with intensely red line at margins.

throughout the mouth were of a cyanotic hue and spongy. The tongue was coated and there was regional lymphadenopathy. Results of a rabbit test were positive. The gums were painted daily with a 2 per cent solution of gentian violet.

Case 4 (Figs. 7 and 8).—A girl, aged 6, colored, complained of fever, malaise, loss of appetite, bleeding from the gums and pain on mastication, of eight days' duration. The gingivae were swollen and of a cyanotic hue. They covered in part the crowns of the teeth. The margins, especially in the region of the lower anterior teeth, were fiery red. A fiery red line (seen in the photograph as a black line) is characteristic. Results of a rabbit test were positive. A 2 per cent solution of gentian violet was applied to the

gums daily. Figure 8 shows the keratoconjunctivitis produced by the rabbit test.

Case 9 (Figs. 9 and 10).—A woman, aged 32, colored, complained of neuralgic pain in the left orbital and temporal region, simulating tic douloureux and of three days' duration. There were aphthous ulcers on the mucous membrane of the left cheek, herpetic vesicles on the lips and regional lymphadenopathy. The gingivae were inflamed and edematous and bled easily on probing. Six intramuscular injections of pituitrin were given. Each injection gave almost immediate relief from the neuralgic pain, lasting for from six to eight hours. After the injections, the pain in the temporal regions subsided, but new neuralgic areas developed in the mandibular region. Thiamine chloride was injected daily for one week with little relief. Deep x-ray treatments were given and the pain subsided. Figure 9 shows the keratoconjunctivitis and vesicle formation in the scarified eye swabbed with the patient's saliva. Figure 10 shows the scarified control eye in the same animal. (The white spots in both figures are highlights.)

Fig. 13 (Case 10).—Ulcer on tongue.

Case 10 (Figs. 11, 12 and 13).—A woman, aged 21, white, complained of extreme pain in the region of the lower molars, where the third molars were partially erupted and gingival flaps were present. The pain simulated that commonly associated with infected gingival flaps over partially erupted teeth. The condition was of ten days' duration. Regional lymphadenopathy and slight fever were present. Figure 11 shows the herpetic lesion on the lip. There was a history of contact with a person having herpes labialis. Figure 12 shows the swollen, inflamed gums with the intensely red line at the margins. Figure 13 shows an ulcer on the tongue. There were other ulcers of this character on the mucous membranes elsewhere in the mouth. All oral mucous membranes were inflamed, as were the mucous membranes of the throat. Results of a rabbit test were positive. Deep x-ray therapy was employed in three fields, one on each side in the region of the lower molars and one in the region of the anterior gums. The pain was less severe, but did not entirely disappear. Local prophylactic measures were instituted. The gums were painted daily with a 2 per cent solution of gentian violet. The pain gradually subsided, and the case was discharged after about two weeks.

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SULFONAMIDE THERAPY IN DENTISTRY: A REVIEW

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HISTORY

SUCH an imposing literature has been accumulating around the sulfonamides that the general practitioner, desirous of learning their application, could hardly find the time to read the complete literature of even one of them. Conflicting views exist regarding their application, and the reported results are such that a review of the most outstanding achievements and contributions appears again to be indicated.

In 1908, Gelmo first synthesized and introduced a new compound, para-aminobenzene-sulfonamide, or sulfanilamide. There followed a period of quiescence during which, buried in the German dye industry, the great possibilities of sulfanilamide remained unrecognized for more than a quarter of a century. In 1932, Mietzsch and Klarer synthesized a water insoluble basic azo dye called sulfamido-chrysoidine or prontosil. In the same year (findings announced in 1935), Domagk demonstrated that mice could be protected against fatal doses of streptococci with prontosil,[88] a relatively nontoxic red dye. At the same time, he announced a new compound, prontosil-soluble (neoprontosil).

In France, Girard synthesized prontosil, and Levaditi and Vaisman confirmed the experiments of Domagk. In 1936, Tréfouël and his co-workers, Mme. Tréfouël, Nitti and Bovet, postulated that the therapeutic action of prontosil was due to its ability to release free sulfanilamide in the body. They also demonstrated that the latter compound was antibacterial. This date marks the opening of the floodgates of sulfanilamide investigation: a new era in chemotherapy was under way. Through its subsequent use in every conceivable disease or condition, no infection has escaped its application.

In England, Colebrook and Kenny found prontosil effective in human streptococcic infections. Buttle and his associates likewise confirmed the work of the French investigators. In addition, they were able to protect mice against meningococcic infections.

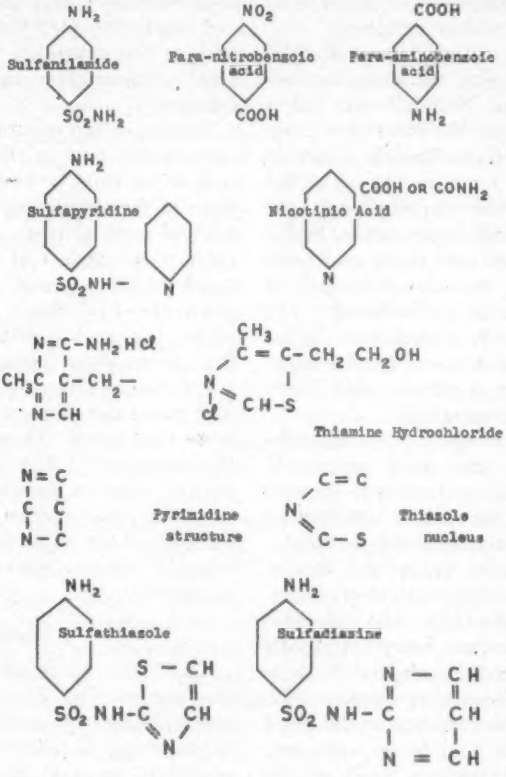
In the United States (1936), Perrin H. Long and his associate, Eleanor A. Bliss, reported that the prontosils and sulfanilamide acted directly on microorganisms to produce bacteriostasis. About the same time, E. K. Marshall, Jr. and his group, Mellon and his colleagues and Rosenthal and his associates contributed outstanding work.

DESCRIPTION

Chemical Properties.—Among the sulfonamide group of compounds available are: (1) neoprontosil, (2) sulfanilamide, (3) sulfapyridine, (4) sulfathiazole, (5) sulfadiazine, (6) sulfacetimide, (7) sulfaguanidine and (8) succinylsulfathiazole. In any evaluation of the sulfonamides, a consideration of para-aminobenzoic acid and para-nitrobenzoic acid appears to be pertinent; hence, their inclusion in this survey.

From an observation of the formulae, it can be seen that the thiazole and pyrimidine rings are substituted for one of the hydrogens of the SO_2NH_2 radical to make, respectively, sulfathiazole and sulfadiazine. The thiazole and pyrimidine radicals are components of thia-

mine, or vitamin B_1. The pyridine ring displaces a hydrogen of the sulfonamide group to make sulfapyridine. The pyridine ring likewise is the basis of the chemical formula of the vitamin nicotinic acid (niacin).[88] Hence, it might be suggested that these drugs are hybrids, being part sulfa and part vitamin. It may also be noted that sulfanilamide itself is structurally similar to para-aminobenzoic acid, which seems to be a vitamin-like substance.



It has been shown recently that such chemical similarity may underlie the antibacterial effect of these drugs. Para-aminobenzoic acid inhibits the bacteriostatic action of sulfanilamide against hemolytic streptococci. Woods holds that this inhibitory action depends on the close similarity in structure between para-aminobenzoic acid and sulfanilamide. Para-aminobenzoic acid is said to be essential for the growth of hemolytic streptococci, which may be able to synthesize it. As a result of this chemical similarity, sulfanilamide is believed to compete with para-aminobenzoic acid in bacterial metabolism and to cripple bacterial growth by displacing it. Dubos states that bacteriostasis seems to be due to "blocking of reactions essential to growth by inhibitors which act on account of their structural similarity to the normal metabolite or growth factor involved." It may be noted that Rosenthal, using the nitro derivatives of some sulfonamides upon selected clostridia, reports that the mechanism of action of

the nitro compounds differs from that of sulfanilamide in that no antagonism is obtained with para-aminobenzoic acid.

Several other theories have been advanced to explain the manner in which the sulfonamides interfere with the metabolism of bacteria. These include the peptone, the peroxide-catalase, the carbonic anhydrase and the oxidation theories (Schnitker, Spink). Of all theories, the para-aminobenzoic acid theory is at present the most widely accepted.

Sulfanilamide, sulfapyridine, sulfathiazole and sulfadiazine are white, crystalline and odorless. Sulfanilamide has a slightly bitter taste, the others are practically tasteless. Sulfanilamide is soluble to the extent of 1 gm. in 100 cc. of hot water. Sulfapyridine is about 0.05 per cent soluble at body temperature. Sulfathiazole is about three times as soluble as sulfapyridine, but only one-tenth as soluble in water as sulfanilamide; i.e., 0.1 per cent at body temperature. Sulfadiazine is soluble in water to the extent of 12.3 mg. per hundred cubic centimeters at body temperature.

Therapeutic Properties.—Sulfanilamide has been the most extensively studied. The data pertaining to it probably apply to the other sulfonamide drugs as well. Sulfanilamide is administered parenterally, orally and locally. The oral route is the method of choice, absorption, chiefly from the intestine, ensuing in about four hours. It rapidly passes into all body fluids, but it accumulates in the presence of damaged kidney function. Concentration in the blood is maximal within four to six hours and, on cessation of therapy, most of the absorbed drug is excreted within forty-eight hours.

The Fate of Sulfanilamide.—A portion is acetylated, forming para-acetylaminobenzene-sulfonamide. This process of conjugation is said to occur largely in the liver. In this acetylated form, sulfanilamide is therapeutically inactive. Another acetyl derivative of sulfanilamide, sulfacetimide, is therapeutically active.[88, 94]

General Therapeutic Applications.—Sulfadiazine seems to be more effective than sulfanilamide in the treatment of infections due to beta hemolytic streptococci (Lancefield group A, B, C and G), and is preferred in infections caused by meningococci, pneumococci and Friedlander's bacillus. Sulfathiazole has been most effectively used in gonococcal and staphylococcal infections. Sulfanilamide is recommended in actinomycosis, and sulfaguanidine in acute bacillary dysentery.

Dosages.—Successful sulfonamide therapy requires that an effective concentration of the drug be maintained continuously in the circulating blood. To reach a blood level of 10-15 mg. per hundred cubic centimeters, 1 to 1½ grains (0.065-0.098 gm.) per pound of body weight is given the first day. More than 200 grains (13 gm.) is seldom given in the first twenty-four hours, including the 50-75 grains given as the initial dose. The remainder is given in divided doses every four hours. These are dosages for the seriously ill. For the moderately ill patient, smaller dosages may be used. Obviously, the precise dosage and the method of administration must be governed by the condition of the individual patient.[88]

TOXICITY

The toxic symptoms vary in seriousness and severity. There may be mild or severe degrees of acidosis, anorexia, cyanosis, dyspnea, dizziness, excitement or exaltation, general malaise, headache, nausea, sleeplessness, skin rash, weakness, vertigo or vomiting. The dangerous symptoms are blood dyscrasia, collapse, diarrhea, fever, jaundice, leukopenia, numbness of hands and feet and tachycardia. Other alarming toxic effects may appear, resulting in acute hemolytic anemia, but these have a favorable prognosis. Agranulocytosis is a rarer com-

plication with a serious prognosis. Renal insufficiency and renal calculus formation are complications often encountered in sulfonamide therapy. Spink doubts the value of an alkali to combat drug acidosis. Fox, Jensen and Mudge give enough sodium bicarbonate to maintain the pH of urine at 7.5 or higher and report the prevention of renal obstruction during massive sulfadiazine therapy.

Cyanosis varies from a mild bluing of the lips or nail beds to an intense slatey discoloration of the entire body. It appears early in treatment and is due to the formation of methemoglobin and sulfhemoglobin. Cyanosis is not considered to indicate discontinuance of the drug, but is serious if anemia is present.

According to Long and Bliss, ". . . the only contraindications to treatment with sulfanilamide is the history that the patient had taken the drug on a previous occasion and had suffered a severe toxic reaction . . . a depressed total white blood count does not contraindicate . . . anemia does not . . ." Schmidt[62] contends that administration of sulfanilamide increases the anoxemia in the presence of nitrous oxide and oxygen. Long and Bliss observed that sulfanilamide administration did not increase the hazards of anesthesia. Treatment with ultraviolet, the x-rays and radium is contraindicated during sulfonamide therapy. In view of the widespread use of the sulfonamides, the number of disastrous responses has been relatively small. But "before an individual is given one of the drugs he should be questioned concerning the previous ingestion of sulfonamide compounds and particularly asked if he has experienced any ill effects," and if the physician has any doubt about the possibility of a patient having a drug sensitivity, a small oral dose (1.5-7.5 grains) should be prescribed and then the patient observed for twelve hours thereafter." (Long *et al.)* Long and Bliss state that the successful use of the drug requires unremitting vigilance on the part of the physician and the patient's attendants. A hemoglobin determination and a total white blood corpuscle count should be made at least once a day during the first week of therapy. Zaus says, " . . . the systemic use of sulfanilamide by the dentist is fraught with too much danger [for it] to be used indiscriminately. When a definite indication for its use arises, it is best for the present that its administration be under the control of the physician who has access to and resorts to the necessary laboratory facilities."

APPLICATIONS IN DENTISTRY

Gingival and Periodontal Disease.—It is generally agreed that Sinclair first used sulfanilamide locally. Routine treatment of pyorrhea with sulfanilamide has not been promising. Edwards states that sulfanilamide therapy has brought about no discernible improvement in pyorrhea cases, and apparently is valueless in controlling this condition, but that some clinicians have reported favorable results from the topical application of sulfanilamide powder following gingival resection. Knebelman has reported successful use of sulfanilamide in gingival infections. Sinclair and Barker hold that sulfanilamide is of no value in the treatment of Vincent's infection. Rantz concludes that the sulfonamide compounds are ineffective in the treatment of pyorrhea, aphthous stomatitis and Vincent's infection. It is said that "claims to the effect that topical application of sulfanilamide in dentistry is of value are almost wholly inferential," and "further investigation, in which provisions for adequate controls and bacteriologic studies have been made, is essential."[22]

Root Canal Therapy.—Adams describes an ingenious procedure for sulfonamide therapy of infected root canals. After carefully cleaning the root canal and making a fistula if none exists, he forces hot concentrated sulfanilamide solution by syringe through the canal

and fistula. The assistant must keep cold running water at the opening of the fistula to prevent burning the mucosa. Adams[4] states that sulfapyridine and sulfadiazine are both so nearly insoluble that either may persist in the tissues long enough to become a foreign body irritant, but that the solubility of sulfanilamide is increased by heat. He reports favorable results and further concludes that no other sulfonamide is so effective as sulfanilamide for the treatment of periapical infection.

Infections Following Tooth Removal.—Many authors have reported good results[26, 31, 40, 48, 67, 98] in cases of cellulitis following extraction, but at least one failure is on record.[97] Goldsmith reported a prompt response in cellulitis arising from the extraction of mandibular third molars.

In the treatment of Ludwig's angina, Conway succeeded in aborting three cases with sulfathiazole therapy. He does not advocate precipitous surgical measures or the exclusive routine of sulfonamides. Williams states that sulfanilamide is not advocated alone, but only as an adjunct to surgical treatment. Williams and Guralnick contend that the presence of streptococci is a clear-cut indication for sulfonamide therapy. They noted no superiority of any one drug, and report that four patients without sulfonamides did as well as others, but sulfonamides are nevertheless recommended.

The treatment for osteomyelitis consists of local application in addition to systemic administration, which has been found to be generally the same as that for cellulitis. Reports have been for the most part favorable.[18, 26, 27, 48, 53, 66, 67] Zaus cites both good results and failures in cases of streptococcal osteomyelitis of the mandible. More recently, Cameron obtained satisfactory results with the internal administration of sulfathiazole for infections in and about the jaws.

Sulfonamides in Fractures.—Bick reported that sulfanilamide when placed in wounds is not completely dissolved and absorbed and may act as a foreign body in delaying healing. Taylor states that three days after implantation of sulfathiazole and sulfadiazine, abscesses were formed about crystals that remained in the tissues. Fox reports that the sodium salts of sulfathiazole and sulfadiazine are suitable for local use in wounds, and that sodium sulfathiazole gave evidence of some tissue irritation, but sodium sulfadiazine in high concentration caused negligible irritation to tissues. Reed and Orr, studying the effect of the sulfonamides on staphylococci *in vitro*, state that leukocytes in the blood phagocytose staphylococci at a normal rate. They also state that *Clostridium welchii* is phagocytosed more rapidly by leukocytes in the body cavities of mice given large doses of any of the sulfonamides than in the body cavities of untreated mice. They state further that more extensive phagocytosis occurs in wounds infected with *Clostridium welchii* or *Clostridium sordelli* and treated locally with sulfathiazole than occurs in untreated wounds.

Results in fractures have been generally good.[26, 45, 46, 48, 50, 54, 84] Jensen, Johnsrud and Nelson treated thirty-nine cases of compound fracture by placing crystalline sulfanilamide in wounds after complete and meticulous débridement. Infection occurred in 27 per cent of ninety-four cases untreated with sulfanilamide. Key and Burford confirmed Jensen *et al.* Kayne reports excellent results when he sprinkled 30-40 gm. of sulfanilamide directly in the wounds caused by compound fracture of the jaws. Haddock reports a marked reduction in the percentage of infection with sulfathiazole therapy. He administered sulfathiazole by mouth and at the site of fracture. Heggie, Kendall and Heggie cited four cases of compound fracture, caused by bomb splinters and other high-velocity particles, which were treated with sulfapyridine and sulfathiazole. They conclude that chemotherapy is a very necessary supplement to the surgical

treatment and should be instituted preoperatively and postoperatively, locally and orally; that therapy applied locally unsupported by simultaneous oral administration is of little value, and that sulfathiazole is more efficacious than sulfapyridine.

In the Spanish civil war, Trueta used the simple method of immediate and continued immobilization of the injured area in a plaster cast. Extension of World War II to the British Isles has caused that government to follow Trueta's principles, but, in addition, prophylactic treatment with sulfonamides is used. During the evacuation at Dunkerque, prophylactic therapy was given a thorough test. U. S. Army physicians on Bataan used sulfanilamide very effectively in wounds until supplies ran out.

Sulfonamides in the Postextraction Socket.—Lanier, in more than 6,000 extractions, reduced the need for postoperative treatment and eliminated dry socket and postoperative pain, confirming similar findings of Sinclair and Barker. The latter, however, reported delayed healing. Successful local application of sulfonamides has been reported by many workers.[8, 9, 20, 45, 52, 66, 69] Ziegler was able, in cases of multiple extraction in a single patient, to observe the effect of placing sulfanilamide in only one socket. He reports less postoperative pain and more rapid closing of the wound in the treated sockets. I have had similar experience with powdered sulfathiazole in a small group of cases. Krashen, in a controlled study, observed that oral administration of sulfanilamide in extraction cases had no significant advantage from the standpoint of healing, and that the local use of sulfanilamide increased postoperative pain and swelling and retarded healing. Stern, from a carefully controlled study of treatment, cites findings that are at variance with those of Krashen. Cameron is not enthusiastic over the use of sulfanilamide following tooth removal. Moorehead contends that the topical application of any of the drugs known at the present time is of no great value after the removal of teeth; that the use of sulfathiazole seems to modify the postoperative discomfort in some cases, and that the range of variation in postoperative sequelae with or without sulfonamides seemed to be about the same.

Sinclair contends that sulfanilamide therapy will not prevent dry socket following excessive trauma. Griess states that cases treated with sulfanilamide showed a noticeable decrease in constitutional reactions, pain, swelling, trismus and lymphadenitis. Albright, who used sulfathiazole routinely in 300 cases, observed that there were few dry sockets, that there was less after-pain and that healing took place more readily. Helbraun reports, from a study in an institution in which many details were carefully controlled, that postoperative pain and infection in cases of slight trauma were no better controlled with sulfathiazole therapy than with saline mouth washes in conjunction with acetyl salicylic sedation. Under conditions of excessive trauma, however, sulfathiazole therapy decidedly reduced the amount of postoperative pain and tenderness, and greatly hastened the healing of tissues.

It may be noted that Griffith *et al.* have used a 5 per cent para-nitrobenzoic acid ointment for postextraction prophylaxis in the following instances: dental abscesses, ankylosis of teeth by sclerosis of bone or condensing osteitis, and lack of blood clot, and in the surgical removal of impacted teeth. The results were gratifying: the incidence of alveolalgia in routine extractions, the average number of surgical treatments necessary after removal of impacted teeth and the healing time of the socket from which the impacted tooth had been surgically removed, all had been reduced. They consider 5 per cent para-nitrobenzoic acid ointment a beneficial adjunct to oral surgery.

Subacute Bacterial Endocarditis.—This is an almost invariably fatal disease, presenting an important practical problem for both the physician and the dentist. In the treatment of this disease, Smith *et al.* recommend a combination of sulfapyridine or sulfathiazole, and protein shock and artificial fever with T.A.B. vaccine, and list several well-authenticated cases of recovery.

It is a well-established fact that bacteremia follows manipulation and surgery. The presence of bacteria can be demonstrated in the blood immediately after the extraction of teeth. Okell and Elliott were the first to recognize this phenomenon. Burket and Burn report an incidence of 17 per cent. Under normal circumstances, the blood is quickly cleared of these micro-organisms. The bacteremia is transient. In individuals having either an acquired or a congenital defect of the heart valves, the consequences may be serious. Bacteria may localize on the valves, and bacterial endocarditis result. Budnitz *et al.* employed sulfapyridine in patients susceptible to subacute bacterial endocarditis and reported negative blood cultures and no major untoward reactions. Northrop and Crowley, on the basis of a preliminary report on the prophylactic use of sulfathiazole in transient bacteremia, state that, in patients with valvular disease, the possibility of an ensuing subacute bacterial endocarditis is diminished by premedication with sulfathiazole.

COMMENT

1. The case in regard to Vincent's infection has been presented elsewhere, but the following citation is readily applicable to the use of sulfonamides in dentistry.

> . . . investigations on medicaments, if they are to provide clear-cut results, must be so conducted as to provide for adequate appraisal . . . observations should indicate whether the medicament studied produced results differing from those afforded by some selected standard agent or, as may have been dictated by experimental requirements, whether use of the drug studied gives results differing significantly from those obtained when an inert agent is applied in the same manner. In brief, the use of an adequate control is essential in biologic investigations. Ideally, there should be a single variable under consideration in scientific testing. This is a point of fundamental importance, but one which is frequently disregarded. Both the medical and the dental literature are filled with reports which are of limited value or are entirely useless because of the investigator's failure to provide adequate controls.[28]

2. The sulfonamides appear to have merit when used locally in the necrotic (dry) or the complicated socket. 3. Their effective use has been reported in the treatment of well-established infections like cellulitis, Ludwig's angina and acute osteomyelitis associated with the extraction of teeth. 4. Acquired sulfonamide hypersensitivity is on the increase and, in some persons, appears to be permanent. Accordingly, its indiscriminate general use by the dentist is to be discouraged. The use of large doses locally is also open to question. Experience may also disclose long-range untoward effects which are not at present recognized. 5. Most extraction cases are uncomplicated, and uneventful recovery is the rule. The routine use of sulfonamides in such average cases appears to be unnecessary. In cases with complications due to trauma and infection, however, there seems to be a valid place for sulfonamide therapy.

Garvin suggests that there is danger of selectively breeding from the original wound flora bacteria that are most resistant to sulfanilamide, and that infections so arising would be resistive to treatment, whereas, if use of the drug were withheld until signs of infection appeared, the nature of the infection would be determined by other and natural conditions and the bacteria concerned might prove very susceptible.

According to this view, it would be better procedure, first, to await the onset of the infection; secondly, to establish its type, and, lastly, to administer the particular sulfonamide in support of the surgical principles called for. 6. Para-aminobenzoic acid being antagonistic to sulfonamides, it should follow that it is illogical to medicate with one of the sulfonamides in the presence of benzocaine and related para-aminobenzoic acid derivatives.

Nitro compounds of the sulfonamides are said to show no antagonism to para-aminobenzoic acid. The use of sodium salts of the sulfonamides topically in wounds causes little or negligible irritation. These two facts hold great promise for the healing profession in general and the dentist in particular. To determine their oral uses, the nitro compounds and the sodium salts of the sulfonamides should be subjected to rigid studies.

The general practitioner is confronted with numerous real problems and seeks answers to many questions. Experimental work seems to be required to fix standard dosages (e.g., in postextraction procedures) and to determine specific intervals between treatments. It appears that more clinical observations of the effects of sulfonamide therapy in subacute bacterial endocarditis are needed before these effects can be appraised. Investigations are indicated to establish possible benefits from the use of sulfonamides in solution, in suspension or in ointments. Such studies, experimental work, observations and investigations, conducted under research and rigid clinical conditions, and based on a sufficient number of cases, might help to put the use of sulfonamides in the dental field on a firmer foundation.

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FACIAL RECONSTRUCTION AND SPEECH

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DENTISTS interested in the reconstruction of disfigured jaws and faces called for in the present war effort, or as a result of accident or in cleft-palate cases, should be interested in changes in position of the tongue and the structures involved in nasopharyngeal closure during speech.

A thorough understanding of this closure is valuable alike to the surgeon, the prosthodontist and the speech correctionist working with organic speech disorders. It is valuable to the otolaryngologist performing cleft-palate operations, since an exact knowledge of the musculature involved in the closure makes possible surgical results which are functionally more satisfactory. The prosthodontist needs this understanding in constructing dental appliances or obturators. Usually, swallowing, and not speech, is foremost in the prosthodontist's mind when fitting an obturator. If the prosthodontist understands the physiology of the nasopharyngeal closure during speech, he not only can fit the obturator to permit adequate swallowing, but also can construct an appliance that will be more satisfactory from the standpoint of speech.

Various observations have been made and several theories have been presented as to the nature of this closure. The most common conception of the action is one in which the soft palate is described as being pulled backward as a flap, coming to rest against the bulge on the posterior wall of the nasopharynx. This bulge, or Passavant's ridge (Fig. 1), is named after the man giving the first comprehensive description of the velopharyngeal closure. According to this theory, the nasopharyngeal (or velopharyngeal) closure is accounted for by the anterior movement of the posterior wall and posterior movement of the soft palate or velum. Wardill[1] was one of the first men to bring out the modern idea that the nasopharyngeal closure is sphincteric in action.

Dorrance[2] states:

> Velopharyngeal closure is accomplished by a sphincter-like mechanism at the lowest part of the nasopharynx, which structure it shuts off from the oropharynx. The structures concerned in causing the closure are the lowermost portions of the nasopharyngeal wall on one side and the velum on the other. The portion of the nasopharyngeal wall which enters into the mechanism is composed of the posterior wall of the nasopharynx; the lateral walls of the pharynx with the eustachian tubes and the salpingopharyngeous bands of the palatopharyngeus muscle. The posterior wall of the nasopharynx where nasopharyngeal closure occurs is formed by the pterygopharyngeal portion of the superior constrictor muscle, which on contraction constitutes what is usually referred to as Passavant's cushion.

One of the more recent explanations of the nasopharyngeal closure is the one advanced by Browne[3]:

> The levator palati and the superior constrictor (act as) two overlapping slings, so arranged that a comparatively small variation in their total length makes a great difference in the calibre of the passage enclosed by them. . . . The direct inspection of the oral surface of the palate, for instance in saying "ah" . . . shows that the center of the palate goes upward and backward into a sort of dimple, just as might be expected from the action of the levator

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palati that has been described. (Fig. 2.) The side walls of the pharynx can be seen to move inward at the same time.

The descriptions of this closure by the prominent surgeons quoted above and others[4, 5, 6] were based on their direct clinical observations of individuals during speech production. While the studies of these investigators made it possible for them to describe the nasopharyngeal closure, they had no method of recording the nature or extent of movement of the parts involved or their relative positions in the production of various speech sounds. However, during the last twelve years, several roentgenographic studies have been made which record some or all of the vertical and anteroposterior movements in nasopharyngeal closure. As yet, no satisfactory method has been devised to record the lateral movements. The tongue, while not entering into this closure, changes position markedly in the production of the various speech sounds and will therefore be included in this roentgenographic illustration of the adaptive changes in position of the structures involved in phonation or speech production.

Other roentgenographic studies[7, 8, 9, 10, 11] have considered only changes in tongue position and so are not so inclusive as the series of studies conducted at the University of Iowa.[12, 13, 14, 15] While these Iowa research studies involved statistical analysis of the nature and amount of movement of the tongue and of the structures involved in nasopharyngeal closure, this paper will mention only the method of producing the roentgenographic records and illustrate the positional changes occurring in the parts involved. All of the Iowa studies employed a head positioner or cephalometer designed by me and which has been described in a previous article.[16] This

Fig. 1.—Profile roentgenogram in which lead diaphragm was used to outline soft tissue profile and reveal structures involved in speech production. P, area of Passavant's ridge (pterygopharyngeal portion of superior constrictor muscle).

equipment (Figs. 4 and 5) stabilizes the head and orients it into correct relationship to the film and midcentral ray of the roentgen-ray machine. This identical head position may be duplicated for a series of roentgenograms on the same individual or for subsequent ones at a later date. In fact, an entire series can be obtained for the same individual without having to release the head from the equipment. In this case, the only part of the equipment that would be changed is the film, the holder for which, however, remains in constant position. Since the head position is thus not disturbed, the only changes that would be registered in the roentgenogram would be those of the organs of speech as they assume position for the production of the various speech sounds. Illustrations and quotations from the Iowa theses covering these investigations are used freely throughout this presentation.

In the first three studies, a radiopaque paste was used to trace the midlines of the posterior wall of the pharynx, hard and soft palate, uvula and tongue. (Fig. 6.) However, in the fourth study, it was found that the paste could be eliminated by using the lead diaphragm routinely employed in profile roentgenography to reveal the soft tissue profile,[17, 18] and thus obtain as good definition as was being obtained by painting the structures. (Figs. 1, 2 and 3.) Compare the results obtained by the painting method with those obtained with the lead diaphragm, Figures 6, 8 and 10.

Figures 6 and 11 show subjects with their teeth closed in physical rest position and all other parts of the oral and nasal cavities inactive. The soft palate hangs down from its junction with the hard palate and follows the curvature of the tongue, the oropharynx and nasopharynx being left completely free of obstruction.

Fig. 2.—Profile roentgenogram showing relation of tongue, soft palate and uvula during nasopharyngeal closure while phonating tone [a]. (Lead diaphragm used instead of radiopaque paste.)

Figures 6, 7, 8, 9, 10 and 11 are a series of roentgenograms of the same patient. Figure 6, as stated previously, was taken with the teeth closed and all other parts inactive, while the other views depict the positions assumed by the tongue, soft palate and uvula while the subject was phonating and sustaining the vowels a, o, u, e, i. The vowels phonated are given below in their respective phonetic symbols:

[a] as in father; [o] as in obey; [u] as in loom; [e] as in late; [i] as in meet.

So nearly constant were the positions taken by the tongue, soft palate and uvula in sounding these vowels for the sixty-five subjects studied that it was easy to select the tone phonated by looking at the roentgenogram and noting the relationship of the parts. Tracings were made for each roentgenogram taken, and those for each subject were transferred to graph paper for comparative study, as shown in Figure 12. Since the tracings were made on cellophane, they could also be superimposed to show the composite picture or to evaluate the kind and amount of change in the relationship of the parts.

When the actual measurable or quantitative changes that occurred and the differences found between normal and abnormal subjects were omitted, the studies resolved themselves into the following generalizations:

A. With reference to tongue position:

1. For the tones [a] and [o], the tongue was comparatively close to the back of the oral pharynx and relatively far away from the palates, with the high points of its arch for [a] somewhat forward of the junction of the hard and soft palate and for [o] behind the junction of the palates. (Figs. 7, 2, 8, and 12.)

2. The position assigned to [o] in the vowel triangle, which is based on the tongue-arching theory, of below and in front of that assigned to [u], does not agree with these findings. Instead, the vowel [o] takes a position below and back of [u]. In fact, it assumed the most posterior position of all the tones studied. (Figs. 8, 9 and 12.)

3. For the tone [u], the tongue was nearly equidistant from the back wall of the pharynx and the palates, the highest point of its arch being just below or very slightly forward from the junction of the hard and soft palates. (Figs. 9 and 12.)

4. For the tones [e] and [i], the tongue was comparatively far away from the back wall of the oral pharynx, with the high point of its arch relatively close to the hard palate anteriorly. (Figs. 10, 3, 11 and 12.)

B. With reference to the position of

Fig. 3.—Profile roentgenogram showing relation of tongue, soft palate and uvula during nasopharyngeal closure while phonating tone [e]. (Lead diaphragm used instead of radiopaque paste.)

the soft palate, uvula and Passavant's ridge in nasopharyngeal closure:

In the rest position (Figs. 6, 1 and 12), the soft palate simply drops from its junction with the hard palate to form a curtain, the mouth and pharynx following the curvature of the tongue and the uvula forming a pendulant tip in the midline. In tone production, however, the soft palate swings upward and backward, to close off, more or less, the nasal pharynx from the oral pharynx and mouth, the uvula swinging downward

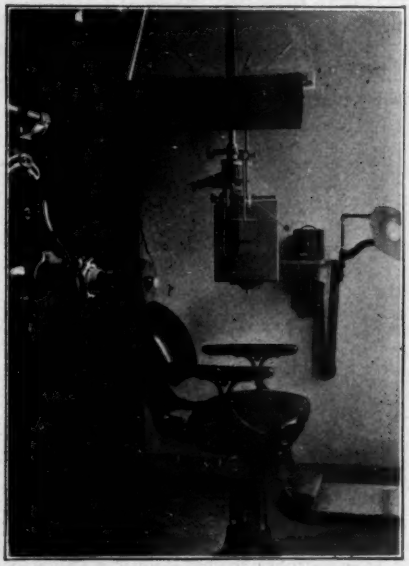

Fig. 4.—Equipment for taking profile roentgenograms. The cassette containing the film is next to the head positioner and, when oriented, the midline of the subject's head is 5 feet from the target of the roentgen-ray tube.

from the posterior border. At the same time, Passavant's ridge bulges slightly anteriorly to contribute in a small manner to the nasopharyngeal closure. The positions ascribed to the various tones are as follows:

1. The soft palate rises the least for the tone [a], the posterior edge including the uvula being well rounded and touching the posterior wall of the pharynx very slightly, if at all. (Figs. 7, 2 and 12.)

2. The soft palate rises slightly more for [o] than for [a], generally touching the posterior wall of the pharynx a bit more definitely. (Figs. 7, 8, 2 and 12.)

3. The soft palate rises decidedly for [i], the posterior edge of the soft palate and uvula being in close contact with the posterior wall of the pharynx, closing off the oral pharynx from the nasal pharynx. (Figs. 11 and 12.)

4. The soft palate and uvula positions

Fig. 5.—Subject's head oriented in head positioner with cassette carried to correct position for exposure.

for [e] are quite similar to those for [i] with the soft palate lower and closing off the nasal pharynx less definitely than for [i]. (Figs. 10, 3, 11 and 12.)

5. The soft palate and uvula positions for [u] are much like those for [i] except that the soft palate is raised less and so closes off the nasal pharynx less than for [i], but more than for [e]. (Figs. 9, 11, 10, 3 and 12.)

6. The anterior movement of Passavant's ridge, while measurable for all

tones produced, is a relatively small factor in nasopharyngeal closure.

SUMMARY AND CONCLUSIONS

1. When the head position is constant, the tongue assumes a characteristic and similar position for a given vowel as articulated by different individuals.

2. When the head position is constant, the tongue assumes a characteristic and highly similar position and formation for a given vowel when articulated by the same individual at different times.

3. The traditional vowel triangle is valid for all vowels studied except [o]. The high point of the tongue for this vowel is here observed to be constantly lower than, and back of that for [u], whereas the traditional triangle has it lower than, but in front of [u].

4. The positions of the soft palate and uvula allow a slight opening between the oral and nasal pharynx for the tone [a], a narrower one for [o], with complete closure for [i], [e] and [u], with the closure greatest for [i], somewhat less for [u] and still less for [e].

Knowledge of the changes in position of the structures involved in speech production will, it is hoped, contribute to the efficiency of the surgeon, prosthodontist and speech teacher in corrective work.

Fig. 6.—Profile roentgenogram in which radiopaque paste was used to trace midlines of posterior wall of pharynx, hard and soft palate, uvula and tongue.

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Fig. 7.—Profile roentgenogram showing relation of tongue, soft palate and uvula during nasopharyngeal closure while phonating the tone [a]. The midlines of the structures were traced with radiopaque paste.

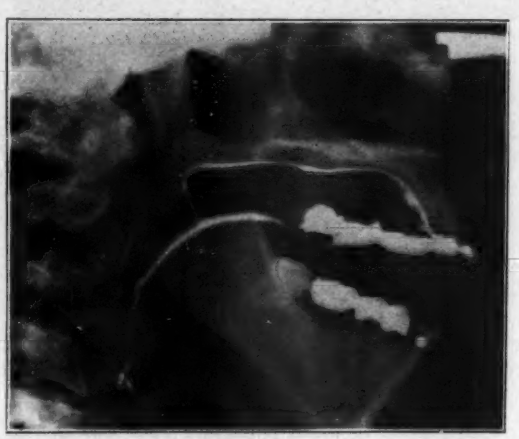

Fig. 8.—Profile roentgenogram showing relation of tongue, soft palate and uvula during nasopharyngeal closure while phonating tone [o]. (Midlines of structures traced with radiopaque paste.)

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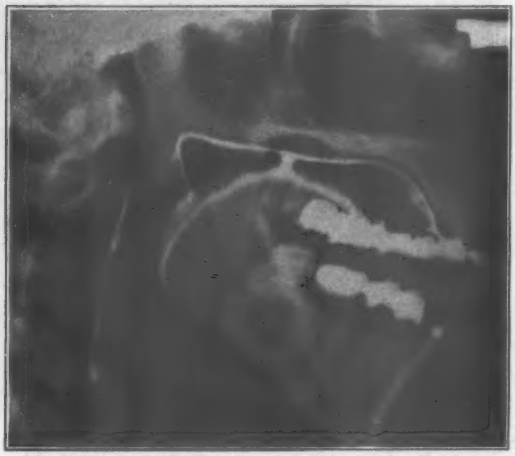

Fig. 9.—Profile roentgenogram showing relation of tongue, soft palate and uvula during nasopharyngeal closure while phonating tone [u]. (Midlines of structures traced with radiopaque paste.)

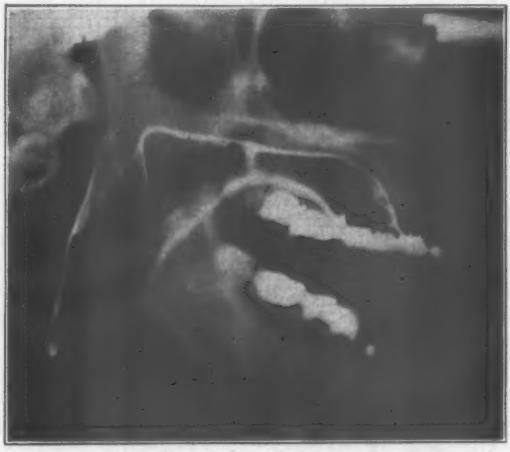

Fig. 10.—Profile roentgenogram showing relation of tongue, soft palate and uvula during nasopharyngeal closure while phonating tone [e]. (Midlines of structures traced with radiopaque paste.)

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Fig. 11.—Profile roentgenogram showing relation of tongue, soft palate and uvula during nasopharyngeal closure while phonating tone [i]. (Midlines of structures traced with radiopaque paste.)

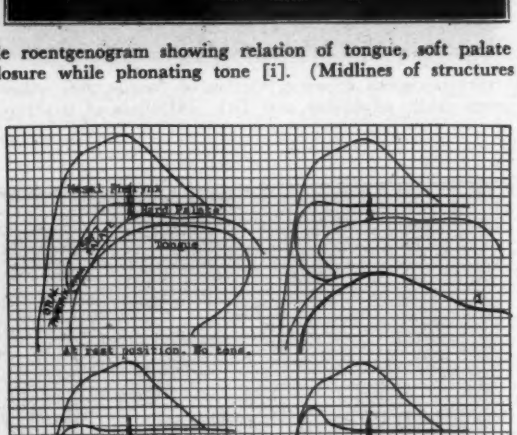

Fig. 12.—Sample of tracings made for each of sixty-five subjects studied. This series is of the subject whose roentgenograms are shown in Figures 6, 7, 10, 11 and 12. It is evident that, for most tones, the tongue folds posteriorly with the median line farther anteriorly than the lateral margins.

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ABRASION AND SOLUTION OF TEETH

A SENSITIVE, VISUAL METHOD FOR DETECTING THESE INJURIES

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EVALUATIONS of experimental data on abrasion or solution by a dentifrice or on the conditions responsible for dental caries are usually accompanied by difficulties and uncertainties. These arise from such problems as:

(1) How hard was the tooth tested?

(2) How much of the effect was exerted on enamel and how much on other constituents of the tooth?

(3) Did the tooth absorb or lose water during the test or weighing?

(4) Is the abrasiveness of a dentifrice, rubbed or brushed against a metallic or vitreous surface, comparable to its abrasiveness when brushed against a tooth?

We were called upon during the year 1942 to make an investigation of certain brands of dentifrices for an agency of the United States Government. During the investigation, it was necessary to devise a method which would make it possible to follow more precisely and more intelligently the changes taking place during the use of a dentifrice. In other words, it was necessary to find out whether a change in weight of a brushed tooth resulted from a loss or a gain in water content, changes in composition, abrasion, solubility of tooth structures or some combination of these possible conditions.

It seemed sound, experimentally, to employ one of the marking or scratching methods used to determine the wear of bearing surfaces to secure visual evidence of the progress of injury to teeth. Any instrument capable of causing, repeatedly, small marks of known dimensions in enamel or dentin surfaces may be used provided loss of surface layers or any change in surface structure is revealed by proportionate changes in these marks.

The pressure of the Knoop pyramidal-diamond indenter,[1] on flat surfaces, under a constant load, produces indentations of definite depth, width and length. (Fig. 1.) It served well in this research. These depressions in the surface are clearly outlined and easily photographed.

Surfaces of enamel or dentin so marked and photographed may then be exposed to the action of an abrasive, a chemical or a dentifrice and again photographed after the exposure. (Fig. 2.) The changes will be evident when the photographs are compared. From such comparisons, it is possible to establish on a single tooth the damage to enamel or dentin developed during the experimental procedure. This definite advantage is not inherent in many other methods employed for studying these problems.

The linear magnifications of the figures shown in this report are, for Figures 1, 4 and 5 B, equal to ×135, and, for the remainder, equal to ×45 when printed to a width of 2⅜ inches. Where the

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†Chemist, National Bureau of Standards.

surface contains dentin, the dentin is in the lower right area of the figure.

The following experimental data and figures on three brands of dentifrice are examples of the value of the method. The problem was to determine whether observed weight losses of teeth brushed with the two dentifrices in question resulted from abrasion or solution of the tooth structure.

The brushing tests were made on the enamel and dentin surfaces of crown sections of teeth cut off above the pulpal chamber. They were held against the rotating bristle wheel with a load just below the load necessary to stall the wheel. The teeth were interchanged so

Fig. 1.—Dental enamel surface polished and indented. (In Figures 1, 4 and 5, the longer indentations are the result of heavier loads.)

that, in most instances, each tooth was tested with the three dentifrices. Data for these tests are reported in Table 1. An approximate evaluation of the effect of the rotating brush in terms of hand-brushing is three minutes of action of the rotating brush equals one year of normal or average hand brushing. Definite injury was produced by hand brushing using both dentifrices, A and B, as shown in Figures 4 and 5.

The principal solid ingredient of powder A is said to be sodium metaphosphate plus a minor percentage of tricalcium phosphate. It is known to be soft and is said to be insoluble. In fact, no abrasive scratches were produced when the powder rubbed against glass, and it is said to cause little abrasion when rubbed against metal. The loss of enamel during brushing with a five-eighths inch dental wheel driven at 1,750 revolutions per minute and constantly bathed in a water-powder mixture was not far from the loss produced by powder B, known to contain abrasives. These losses of enamel are small and perhaps are of minor dental significance. (Table 1.) The loss of dentin with soft powder A is, however, three times as great as the loss with paste C, a dentifrice which complies with the Federal Specification.[2]

The question naturally arises: How can a slightly abrasive dentifrice do so much damage to the dentin of a tooth? A suspicion of solvent action came when we examined the surface injury shown in Figure 4. This surface does not show typical abrasive injury. The injury produced when powder B was brushed by hand, precisely as powder A was brushed, against another surface of enamel, was a typical abrasive injury. (Fig. 5, A.) The surface, in Figure 5, B, near the indentations, appeared to have been scooped out and pushed away. The surface brushed with powder A did not show this uniform removal of enamel over the entire brushed area. There appeared to be local pitting or honeycombing of the surface, and the general outline of the indentation was better preserved, though there were typical edge and angle losses on the indentation which are characteristic of chemical attack. This was confirmed in the following tests.

Plane surfaces were cut on teeth selected for the maximum of apparent soundness. The cutting to plane surfaces was done progressively on flat disks using finer and finer carborundum powder as the cutting agent. The final polish was produced on a velvet coated disk using wet magnesium oxide as the polish-

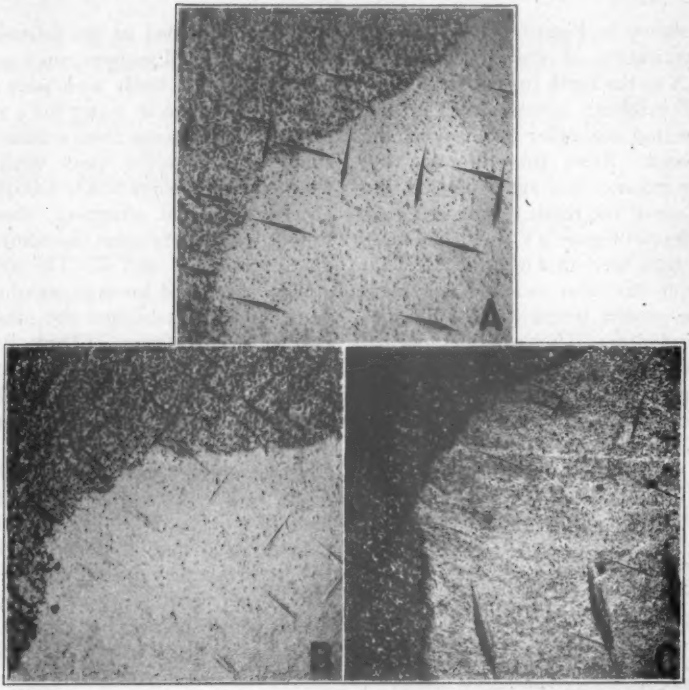

Fig. 2.—A: Enamel-dentin surface polished and indented. B: Same surface after five days' exposure to water solution of powder A. C: Same surface after four months' exposure to water solution of powder A. The diamond hardness indenter was again applied to the surface (at the end of the four months) with the same load as that used on A. The solvent and softening actions are evident.

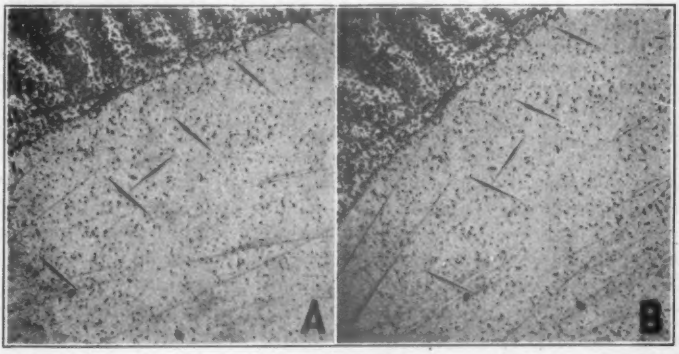

Fig. 3.—A: Enamel-dentin surfaces polished and indented. B: Same surfaces after five days' exposure to water solution of powder B. No solvent action is evident in the exposed dentin.

ing agent. Marks were placed on both the enamel and dentin surfaces with the indenter and the teeth were immersed in a mixture composed of water and the dentifrice to be tested.

The chemical attack on the exposed

dentin, shown in Figure 2 B, developed from application of the wet dentifrice powder A to the tooth for five days without any brushing whatever. The test was repeated on other teeth with the same result. After four months, the hardness indenter was again pressed into the surface of the tooth shown in Figure 2 A (compare Figure 2 C) with the same load as that used in Figure 2 A. That the dentin has been softened is evident from the greater penetration of the diamond indenter. The original normal hardness of about 50 (Knoop number) has dropped to about 20 for the surface of the dentin. Figure 3 B shows no such effect when a tooth is similarly treated

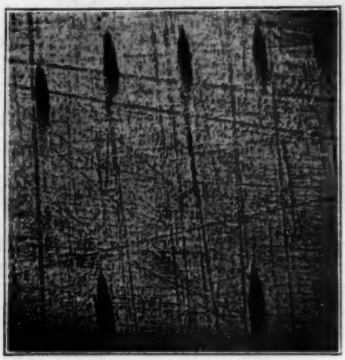

Fig. 4.—Dental enamel surface polished, indented and brushed twenty-five minutes by hand with water paste of powder A. The difference between an apparent solvent action here and the positive abrasive action in Figure 5 is evident.

with another wet dentifrice, powder B. Hardness tests on the surface shown in Figures 3 A and 3 B were repeated at the end of five months' exposure to powder B. No such attack as that disclosed in Figure 2 B or 2 C was evident. The fine scratches left in polishing the tooth were still visible after the five months' exposure. Dentifrice powder A mixed with water chemically attacks tooth surfaces.

Further confirmation of chemical attacks was obtained in the following experiments. Small sections, such as cusps, were cut from teeth and were conditioned by storage in water for a number of days. They were then washed in alcohol and ether for quick drying and weighed on a magnetically damped balance. After the weighing, they were stored for twenty days in solutions of dentifrices A, B and C. The action of powder A caused losses in weight of 0.2 per cent and established the solvent action by the dentifrice. (Table 2.) This is not surprising, as sodium metaphosphate is a chemical frequently recommended to produce decalcification when such action is desired in industry. Dentifrice A yielded 0.3 per cent soluble phosphate rather consistently even after fifteen leachings. Figure 2 confirms the damage indicated in Table 2. Perhaps the greatest injury to be anticipated from the use of dentifrices containing such decalcifying ingredients would come from the particles of powder lodged between the teeth or under the gums, where they may be expected to continue their action during twenty-four hours of each day, unless they are completely dissolved before the next application of dentifrice.

We have extended this method of investigation to effects other than those from commercial dentifrices and had hoped to complete a study of the effects from sugar solutions, fluorine, alginate (a recent component of some dentifrices) and similar chemicals which might enable us to obtain data of value in researches related to dental caries. We find ourselves unable to continue the work now and can see no opportunity to do so in the near future.

The following figures and comments are recorded with little attempt to evaluate their significance.

Figures 6 to 11 inclusive show the effect of exposing tooth enamel and dentin to sugar solutions under various conditions. One of the theories of dental

TABLE 1.—LOSSES OF ENAMEL AND DENTIN DURING BRUSHING*

Specimen	Brushing Agent	Loss in Weight† Mg.
Dental enamel (Duration of tests, twenty-five minutes)	Powder A	1.1
	Powder B	1.3
	Paste C	1.0
	Powder A plus 25% FF carborundum	15.6
	Water	0.0
Dentin (Duration of tests, three minutes, average)	Powder A	22.6
	Powder B	34.6
	Paste C	7.0
	Water	+0.2‡

*By wheel brush, five-eighths inch, driven at 1,750 R.P.M.
†Average for two or more tests.
‡Apparent gain only. Accuracy of weighings is thought to be ±0.2 mg.

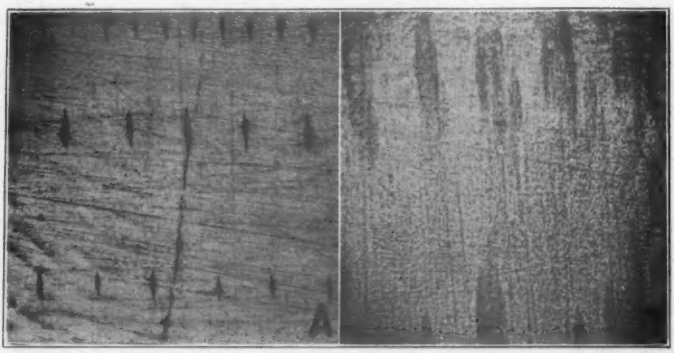

Fig. 5.—Dental enamel surfaces polished and indented. A: Same area as Figure 1, brushed twenty-five minutes with powder B. B: Same area as Figure 4, brushed twenty-five minutes with powder B after twenty-five minutes' brushing with powder A.

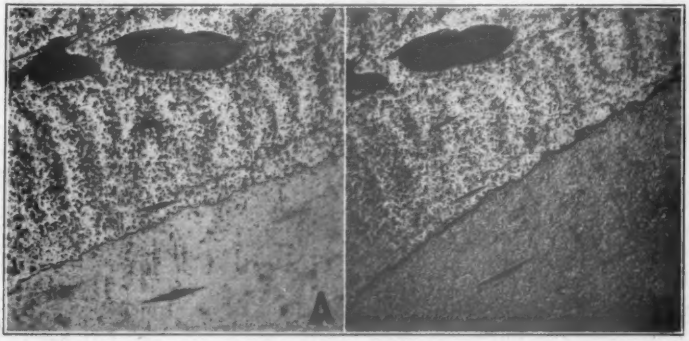

Fig. 6.—A: Enamel-dentin surfaces polished and indented. B: Same surfaces after four days in 20 per cent solution of granulated sugar in water. (The darker ovals are folds where the contour of the enamel runs below the plane of polish.)

TABLE 2.—SOLVENT ACTION OF TWO TOOTH POWDERS*

Solution	Initial Weight of Tooth Crown, Mg.	Weight After Twenty Days, Mg.	Loss in Weight Mg.
Powder A in water (Saturated solution)	605.3	604.3	1.0
	510.2	509.0	1.2
	841.8	840.0	1.8
	228.0	227.3	0.7
Powder B in water (Saturated solution)	677.2	677.1	0.1
	381.9	382.0	0.1†
	285.2	285.2	0.0
Water (distilled)	436.3	436.1	0.2
	146.9	147.0	0.1†

*Sections of teeth immersed in diluted dentifrice.

†On these specimens, there was an apparent gain. Since the accuracy of the weight is thought to be ±0.2 mg., a gain in weight is not established.

Fig. 7.—A: Enamel and dentin surfaces polished and indented. B: Same surfaces after five days in water solution, sugar and calcium hydroxide (20 gm. of sugar and 5 gm. of calcium hydroxide per hundred milliliters of water). C: Same surface after six days in sterile 20 per cent sugar solution. D: After six days in 20 per cent sugar solution to which had been added 20 gm. of calcium sulfate and 2 milliliters of saliva for each hundred milliliters of solution.

caries is based on the idea that the action of oral organisms on refined sugars produces organic acids which attack tooth surfaces. If this process is confined to an isolated and protected area, carious lesions are said to result from such an acid attack.

Figure 6 shows A, the freshly polished surfaces of enamel and dentin, and B, the same surfaces after four days in a 20 per cent solution of granulated sugar.

Figure 7 shows A, the polished surface of enamel and of dentin treated in sequence; B, these surfaces after five days in a water mixture containing 20 gm. of granulated sugar and 5 gm. of calcium hydroxide ($Ca[OH]_2$) for each hundred milliliters of water (the pH of this solution was 12.3); C, the same surface after six days in a sterile water solution containing 20 gm. of granulated sugar for each hundred milliliters of water

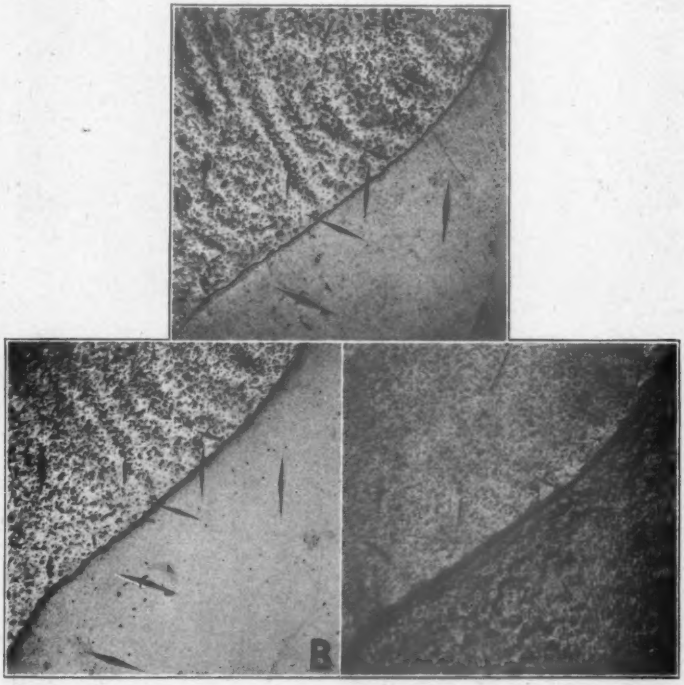

Fig. 8.—A: Newly polished surfaces of enamel and dentin. B: After five days in crude molasses (pH 4.3). C: After five days in solution containing 20 gm. of granulated sugar and 2 gm. of sodium alginate per hundred milliliters of water (pH 4.3).

No attempt was made to sterilize the sugar solution or to prevent bacterial action. Definite attack of the tooth surfaces is evident from the lack of sharp and definite edges of the indentation marks in Figure 6, B. The darker ovals in the enamel are folds where the contour of the enamel runs below the plane of polish.

(the pH of this solution was 6.7), and D, these surfaces after six days in a water mixture containing 20 gm. of granlated sugar, 20 gm. of calcium sulfate and 2 milliliters of fresh saliva for each hundred milliliters of water (the pH of this solution after six days was 3.3). No attack was observed in the sugar solution rendered alkaline by the calcium hydrox-

ide, nor was there any attack by the sterile sugar solution in which bacterial action was prevented. Severe attack did occur, however, when bacterial action was permitted in the sugar solution containing the calcium sulfate. In this and the following experiments in which bacterial action is discussed, actual bacteria counts were not made. Bacterial action was assumed to have occurred when gas bubbles could be observed escaping from the solution and when the solutions became progressively more acid.

Figure 8 shows (A) newly polished surfaces of enamel and dentin; (B), after five days in a crude, not sterilized, molasses (pH 4.3) and (C) after five days in a water solution containing 20 gm. of granulated sugar and 2 gm. of sodium alginate for each hundred milliliters of water. The pH of this solution at the time the tooth was immersed was 4.3. It is of interest to note that no attack on the tooth surfaces occurred in the crude molasses and that the same surfaces were severely attacked by the refined sugar solution.

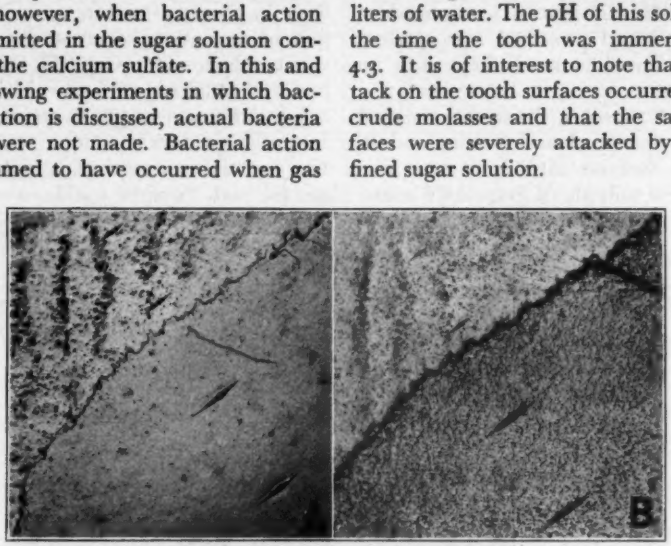

Fig. 9.—A: Newly polished surfaces of enamel and dentin. B: Same surfaces after five days in "raw" sugar solution (pH 4.0).

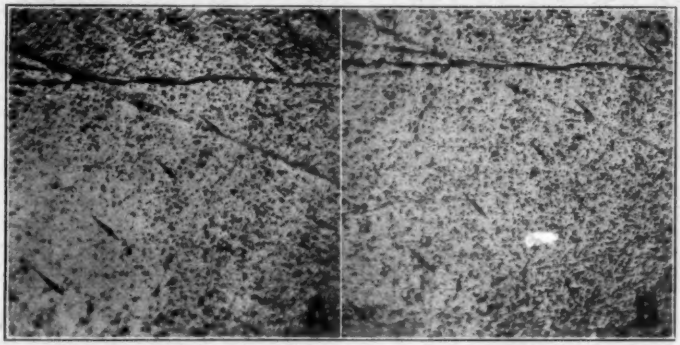

Fig. 10.—A: White spot in enamel surrounded by clearer enamel. B: Same area after five days in "raw" sugar solution.

Figure 9 shows, A, newly polished surfaces of enamel and dentin, and, B, these surfaces after five days in a water solution containing 20 gm. of raw sugar for each hundred milliliters of water. The pH of this solution was 4.0. A severe attack occurred. It should be

pointed out that, although the raw sugar is a crude product, some refining has been done, and it is not so crude as the molasses used in the previous experiment.

Figure 10 shows, A, a white spot in the enamel surrounded by clearer enamel; and, B, the same surface after five days in a water solution containing 20 gm. of raw sugar for each hundred milliliters of water. The white area was definitely softer than the surrounding clear enamel, as is indicated by the longer marks in the white area. The actual Knoop hardness numbers were 250 (kilograms per square millimeters) for the white area, and numbers up to 350 were obtained for the clear enamel. Such soft white areas are considered by some dentists to be more susceptible to attack and are the areas where carious lesions are most likely to occur provided the white spot extends to the surface of the tooth.

Figure 11 shows, A, newly polished surfaces of enamel and dentin; B, these surfaces after nine days in a mixture containing 100 gm. of a base exchange material (1R4 sold by Resinous Products Chemical Co., Philadelphia, Pa.) to each hundred milliliters of water; C, these surfaces after twenty-four hours in a diluted solution of hydrofluoric acid (approximately 1 part per million), and, D, the surfaces after nine days in a water solution containing 20 gm. of granulated sugar and 2 milliliters of fresh saliva for each hundred milliliters of water. It is

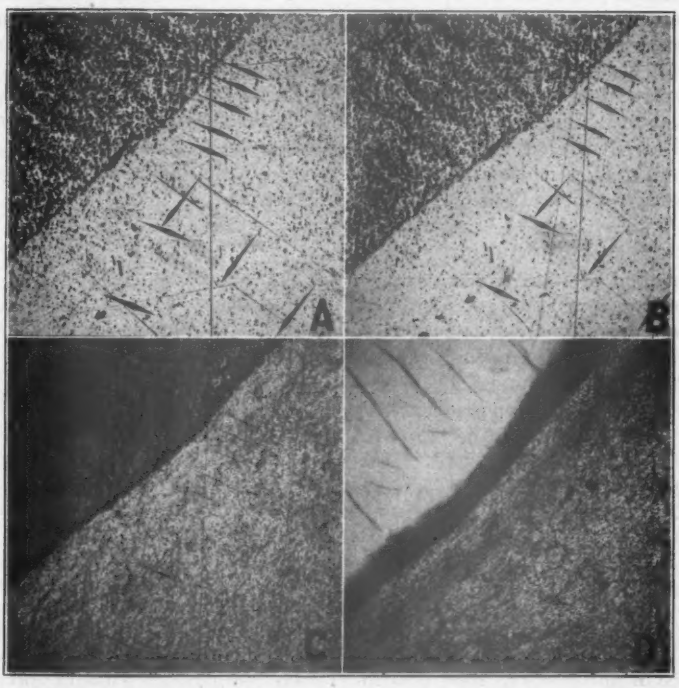

Fig. 11.—A: Polished surfaces of enamel and dentin. B: After nine days in water mixture containing base exchange material. C: After twenty-four hours in diluted hydrofluoric acid solution. D: After nine days in sugar solution containing mouth bacteria.

evident that the hydrofluoric acid solution was too concentrated. The fluoride treatment, however, afforded no protection to the tooth against further attack by the sugar saliva solution, as shown in Figure 11, D, in which the enamel is severely corroded.

Sections of teeth stored in sugar solutions for several months (minimum about two months) in which bacterial action was not prevented showed a severe attack on the enamel and a much less severe attack on the dentin. Actually, the enamel could be pushed away as a sort of pastelike coating, leaving the dentin scarcely attacked at all below the original surface. The same general type of attack is illustrated by the enamel in Figure 11, D, after storage for nine days in a sugar solution.

SUMMARY

The method of research employed is more effective in its application and permits more definite visualization of injury to teeth than any method hitherto described.

The injury to enamel from a dentifrice containing harsh abrasives is definitely evident after twenty-five minutes brushing with a toothbrush using a technic similar to that employed daily by millions.

Injury of enamel and dentin occurs from the use of a dentifrice containing a decalcifying ingredient.

This method of investigation offers exceptional opportunities for studying minute areas of teeth—enamel, dentin and restoration margins, with a definiteness not hitherto possible. It should be of unusual value in laboratory studies of dental caries, wherein it will be possible to detect changes in tooth structure in a few days; detection of which might require weeks or months by other methods.

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SURGICAL PREPARATION OF THE MOUTH FOR IMMEDIATE DENTURES

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SCIENCE and research have contributed greatly to the advancement of prosthetic dentistry in the last decade. Chemistry has given us the hydrocolloids, the new plastics, lifelike porcelains and new and approved alloys of base metals and gold. The profession has perfected refined precision technics of tooth preparation, mouth preparation and construction, making possible partial restorations and complete dentures of superior function, greater esthetic value and greater comfort. The prosthetic dentistry of today has, indeed, been streamlined.

The construction of immediate dentures has become an accepted procedure in most dental offices. Surgical preparation of the mouth is likewise accepted

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and common practice in both immediate and delayed denture service. There is nothing new or fantastic in the fundamental principles of immediate denture construction. The profession has long been aware of the inherent advantages of immediate or early replacement of extracted teeth, as evidenced years ago by almost universal approval of temporary or treatment dentures. It has likewise been conscious of the mechanical and esthetic advantages of surgical preparation of the mouth.

A new interest has been manifested in the combined procedure, however, in the last decade, creating virtually a new field in denture prosthesis. Denture patients are exacting and critical in their demands upon the profession. It is not unreasonable to anticipate that patients of this generation, who expect to have scars of accidents and wrinkles of age removed, and even faces completely rebuilt, may undergo the minor surgical measures necessary to supply them with serviceable, good-looking and comfortable restorations. For years, dentists attempted to overcome mechanical disadvantages in ridge form and jaw relationship by construction and design, and, to say the least, they did exceedingly well considering the handicap under which they labored. Today, however, an ever increasing number of general practitioners, as well as prosthodontists, are taking the more sensible and direct route of surgical elimination.

ADVANTAGES

All persons are not amenable to immediate denture service or mouth preparation, but when such service is decided upon after the evaluation of the individual case, advantages accrue to both patient and dentist. When supplied with immediate dentures, patients have less swelling, postoperative pain and discomfort, in most instances, than when the extraction wounds are unprotected and are exposed to the mouth fluids and the irritation of mastication. The denture serves as a surgical splint, protecting the wounds, creating gentle pressure on the tissues and aiding in the control of hemorrhage and in the maintenance of normal and undisturbed blood clots in the tooth sockets, hastening repair of the tissues. It is not uncommon in extraction wounds thus bandaged to see the same degree of healing clinically in forty-eight hours that is seen in unprotected sockets and incisions in a week's time. The uniform intermittent pressure of the surgical splint also stimulates bone to regeneration.

From the patient's viewpoint, undoubtedly the most important advantage is the elimination of the humiliating edentulous period. Delay in the removal of infected teeth is often due to fear of embarrassment and humiliation from being seen without teeth. This emotion frequently becomes an obsession that overbalances good judgment, and areas of focal infection are tolerated for months or years with the patient's full knowledge of the menace to his health. The fact that the actual transition can be brought about in one short appointment, with no loss of time, or only a short absence from business or employment, is appealing. During this short transitional period, the patient suffers little functional disturbance and is not given the opportunity to develop bad masticatory habits.

Another reason for procrastination is the fear of lost identity. The patient's morale will be bolstered immeasureably if he can be made to realize that there will be no major change in his appearance not predetermined. He should be informed that records are to be made, and that tooth size, form, color and position will be maintained, and that the relation of the jaws and the facial contour will be the same, unless modified on agreement, when modification appears to be a distinct advantage as regards function or appearance. The foregoing

advantages can be obtained for the patient by immediate replacements. All the benefits realized for the patient, to a greater or less degree, accrue to the dentist, enabling him to render the type of professional service worthy of a health profession.

DIAGNOSTIC FACTORS

The physical condition, temperament and age of the patient are the first considerations in determining the desirability of an immediate replacement. Persons who are not good surgical risks should be ruled out because this type of restoration necessarily involves multiple extraction and often surgical measures. These include hemophiliacs, diabetics, syphilitics and patients with blood dyscrasias, nervous disorders or certain nutritional deficiencies. Resistance, tolerance and a correct mental attitude are essential whether the patient is young or old, but more complete cooperation can be expected from the young. This method of treatment is rarely indicated for elderly people.

Roentgenograms, not only of the remaining teeth, but also of the edentulous areas, should be made that the roots of the teeth and the condition and density of the bone may be studied. Residual infection, retained root fragments and embedded teeth are frequently revealed in the edentulous areas. The size and the relation of the maxillary sinuses to the crest of the ridge can be observed. This is important if reduction of the tuberosities is indicated to gain vertical dimension in the molar region. The thickness of the fibrous tissue tuberosities is also disclosed.

A clinical and digital examination of the mouth should be made, noting the number and condition of the remaining teeth, general tone, color and density of the soft tissues, contour and relationship of the ridges, vertical dimension (particularly in the tuberosity region), throat form, muscle attachments and bony prominences. Finally, the facial contour and jaw relationship should be studied from both a front and a profile view.

PREEXTRACTION RECORDS

Certain preextraction records are advisable since they serve as a guide and reference in constructing the restoration and extracting the teeth and in the surgical preparation of the mouth. These include the intra-oral roentgenograms made as an aid in diagnosis, articulated study casts and preoperative photographs, front and profile views, or a profile extra-oral roentgenogram. Facial measurements may also be made.

MOUTH ANOMALIES

The frequently encountered mouth anomalies will be considered in their relation to immediate denture construction. These abnormalities and malformations will be classified under two headings: first, those composed of hard tissue; second, those composed of soft tissue. Then traumatic deformities and abnormal muscle attachments will be considered.

In the maxilla, possibly the most frequently encountered abnormality in ridge form is the massive undercut bony tuberosity. The presence of such tuberosities does not permit proper peripheral adaptation of the denture at the heel of the jaw, but results in a deformity in the normal occlusal plane of the jaw ridge, and frequently encroachment upon the denture space in the molar region so that there is insufficient intermaxillary space to include and anchor the molar teeth in the restoration. The next consideration is an irregular and shelflike prominent formation of the buccal bone plate, producing undercuts in the buccal surface of the ridge. Undercuts of any considerable depth make it impossible to secure proper peripheral adaptation in these areas.

A protruding, overdeveloped alveolar process in the anterior portion of the

maxilla is the most common abnormality in this region. This condition may be so extensive that it causes a major discrepancy in interjaw relationship, presenting a problem in esthetics in the construction of the denture. When the protruding process is badly undercut at the mucolabial fold, a problem in mechanics results. Dentures constructed over this type of jaw have the tendency to be driven forward, over a period of years, by the incising stress exerted upon the anterior teeth, causing the formation of hypertrophied tissue on the anterior ridge.

The denture will serve much more satisfactorily under the stress of function if the labial plate of bone is fairly vertical. In the hard palate, a bony excrescence known as *torus palatinus* occasionally is found, in the region of the median palatine suture. This hard, solid elevation, essentially bony, may vary from a minor elevation to a large spindle-shaped or lancet-shaped growth occupying two-thirds of the palate. Miller and Roth,[1] in a study of *torus palatinus,* conclude that the average percentage of occurrence in the population is 24.2 and that the ratio of male to female is 1 : 2. It is obvious that when of considerable size or badly undercut, these prominences interfere with the palatal adaptation of the denture.

In the mandibular ridge, one may find irregular and prominent labial and buccal bone formation, and sometimes shelflike prominences of considerable size lingually from the bicuspid teeth *(torus mandibularis).* These abnormalities in the ridge form of the lower jaw present the same difficulties in denture construction that they present in the maxillary ridge.

The most common soft tissue abnormalities are large fibrous tissue tuberosities and broken-down flabby tissue ridges and tuberosities which interfere with denture stability. Hypertrophied tissue may be found in mouths where ill-fitting partial prostheses have been worn, or where the hard tissues have been broken down beneath a partial denture worn in unbalanced occlusion. The presence of hypertrophied tissue may interfere with denture stability or peripheral adaptation, according to its location in the mouth.

The traumatic deformities in ridge form are chiefly (1) those caused by loss of tissue following surgical procedures necessary to eradicate a diseased condition or (2) those produced by complicated extractions or careless technic. Abnormal muscle attachments and broad fibrous attachments, including the labial frenum, sometimes extend onto the crest of the ridge, and occasionally demand so much relief at the periphery of the denture that they interfere with retention.

INDICATIONS FOR ALVEOLECTOMY

There is a diversity of opinion as to the need and indications for alveolectomy in immediate replacements. Primarily, surgical preparation of the mouth is indicated for the correction of irregularities and deformities of the jaw ridges or for esthetic reasons, rather than for the removal of diseased tissue. It should not be difficult to decide what surgical preparation is necessary after evaluating the findings in the individual case. Many cases require no preparation other than the extraction of the remaining teeth and reduction of any sharp process or removal of flabby tissue on the crest of the ridge. Some mouths require more extensive correction and, occasionally, radical alveolectomy is advisable.

The esthetic effect, functional efficiency and comfort that can be obtained in any immediate denture case is in direct proportion to the anatomic form and quality of the supporting hard and soft tissues and to the relationship of the jaw ridges. Corrective surgical measures should eliminate or modify major abnormalities in ridge form, but the amount

of reduction desirable can be determined only after consideration of the interjaw relationship.

PRECAUTION IN EXTRACTION AND SURGICAL PROCEDURES

Care should be exercised in the extraction of teeth at all times. Inflamed gum tissues should be treated, and teeth with heavy deposits should be scaled, particularly before extractions for the immediate insertion of dentures. Traumatic deformities and abnormal tissue attachments are often the result of careless technic in extraction and failure to establish the symmetry of the ridge at the time that the teeth are removed. This is particularly true when a group of adjacent teeth are extracted at one sitting.

The attitude of the profession toward multiple extraction tends to become more conservative. In past years, it was a not uncommon practice to remove ten or twenty teeth at one sitting, under either local or general anesthesia, with little thought of the patient's resistance, the amount of infection or tissue conservation. It is highly significant that today the patient's physical condition, resistance and tolerance and the infection present are more carefully determined before multiple extraction and surgical operations. A complete history should be obtained, and sometimes a physical examination, including blood tests and urinalysis, is necessary. When required, corrective and supportive measures should be instituted. Medication, dietary considerations and vitamin therapy are prerequisite to surgical procedures in the mouth as in other parts of the body. Even though infection in the mouth is the apparent cause of physical disability, it is important that the general resistance of the patient be built up before removal of infected teeth, operations for other pathologic conditions or corrective surgical measures.

ANESTHESIA FOR ALVEOLECTOMY

Local anesthesia is preferable for surgical preparation of the mouth. The technic for injecting the anesthetic should be used for routine extraction of teeth. In using a local anesthetic, it is not necessary to hurry the procedure. The operator has the patient's cooperation, a dry operative field can be readily maintained and painless adaptation of the denture is possible.

PREPARATION OF POSTERIOR RIDGES

Extraction of the posterior teeth is recommended by many authorities as a preliminary to impression taking. If this method is followed, the posterior ridge form should be established in the same operation. Other authorities advise only the removal of roots and third molars, malposed, loose or badly broken down teeth and those showing extensive periapical involvement or hypercementosis, prior to taking impressions.

In presenting the technic of preparing the posterior ridges, it is assumed that the first method is to be used and that the bicuspids and molars are to be extracted on one side of the jaw at one sitting, and that reduction of the ridge including the tuberosity is indicated. After extraction of the teeth, an incision is made along the crest of the ridge beginning posteriorly from the tuberosity and extending forward to the cuspid tooth. Care should be taken to carry the incision down through the periosteum. The mucoperiosteal flap is carefully freed from the buccal plate of bone just high enough to expose the bony projections, and is held retracted. The buccal ridge is then prepared to the desired form with rongeurs, chisels or files. The lingual flap usually is freed just enough to expose the crest of the ridge so that it can be reduced or smoothed.

In the tuberosity region, the lingual flap must be freed slightly more to permit reduction of broad bony tuberosities.

Fibrous tuberosities require that a wedge of tissue be removed from the crest of the ridge. The soft tissue flaps should be trimmed with serrated scissors so that they approximate, with care that the mucobuccal fold be not lowered. Three or four interrupted silk sutures should be placed to hold the flaps in position. Occasionally, the buccal flap is raised before extraction of the teeth, and portions of the bone plate are removed to facilitate the removal of teeth that have hypercementosed roots or present other deformities or pathologic involvement. Care should be exercised throughout the operation to avoid undue trauma to the soft tissues. A U-type ridge is desirable and overreduction may leave the supporting tissues in less advantageous form than had no surgical procedure been undertaken.

When this method of preliminary extraction and reduction is followed, it is advisable that at least three weeks elapse before the final impressions are taken. After the impressions are secured, and central occlusion and the bite are registered, the casts are poured and mounted on the articulator.

TRIMMING THE MASTER CAST

The next consideration is the trimming of the master cast. As pointed out previously, many cases need little or no change in ridge form, while others may require considerable reduction. The plaster teeth should be cut off, and the labial surface and the crest of the ridge should be cut away to the desired contour, the articulated study models serving as a guide. Care should be exercised in trimming the labial surface, that no relief extend within 3 or 4 mm. of the mucolabial fold. Relief should never extend into the peripheral or valve-seal area. The method used in trimming the cast and setting up the teeth is optional. Most of the various technics in use will have satisfactory results. A slight modification in the natural tooth arrangement is often desirable, and one particular modification must frequently be made in order to secure a balanced occlusion in the completed denture. According to Glupker,[2] there must be a normal overlap between the maxillary and mandibular teeth, and if this relation is not present in the natural teeth, the positioning of the artificial teeth should not duplicate the natural tooth arrangement. Many other authorities concur in the opinion that there must be a normal overlap or overbite established.

THE TEMPLATE

When considerable reduction is to be made in the anterior portion of the jaw, or when the second method is followed and posterior teeth are also to be extracted at the time of the mouth preparation, it is advisable to construct a template as an aid in shaping the jaw. A template, as referred to here, is a matrix or mold to be used in the surgical operation as a guide to the form and contour of the ridge. It is shaped over a duplicate of the trimmed master model, and is often called a surgical matrix. A transparent base made of celluloid has been most commonly used. This material has given some difficulty because it warps easily. The most satisfactory templates are made of vulcanite or acrylic resin, constructed with windows or areas cut out where the teeth are still retained and where the ridge surfaces are to be reduced. The margins of these areas are designed with a slight bevel, and removable inserts are adapted to the model. These inserts may be of clear acrylic, or just modeling compound may be used.

This type of template can be placed in position in the mouth on extraction of the teeth, and it will become seated before any surgical procedures have been performed. Areas that were trimmed on the cast can then be checked by placing

the inserts to determine the amount of reduction necessary. When the jaw has been properly prepared, the inserts should become seated perfectly. If the patient is referred to an oral surgeon for the mouth preparation, a duplicate of the trimmed master cast or a template should be sent as a guide to the amount of surgical work necessary. Some dentists prefer to have the oral surgeon trim the master cast.

PREPARATION OF ANTERIOR RIDGE

When the six anterior teeth have been retained and are to be extracted at the time of mouth preparation, incisions are made, beginning on the crest of the ridge distally from the cuspid teeth and extending a short distance posteriorly on the ridge and then obliquely toward the mucobuccal fold. These two incisions are then connected by an incision on the labial surface at the gingival margin. The first two incisions are extended posteriorly just far enough that, when the mucoperiosteal flap is elevated, there will be accessibility to that portion of the ridge to be reduced, without tearing or traumatizing the soft tissue. The mucoperiosteal flap is carefully freed from the labial plate of bone, beginning at the gingival margin of the teeth. The flap should be freed just high enough to expose the prominences that are to be reduced. The teeth are then extracted, and the anterior ridge is prepared in the desired form. It is rarely necessary to elevate the lingual soft tissue, which should be freed just enough to smooth the crest of the ridge. The excess tissue should be trimmed from the gum flaps so that they approximate. The teeth may be extracted before the gum flap is raised. The incision is sometimes made after the teeth are extracted.

As pointed out previously, no preparation of the anterior ridge is necessary in many cases, other than reducing or smoothing the sharp interseptal bone. If considerable bone is to be removed, or when posterior teeth are to be extracted at this sitting, it is advisable to use a template to check the contour of the ridge as one proceeds with the operation. When the inserts of the template are seated properly, or the denture has been seated to determine that the ridge has been properly contoured, the sutures are placed. About four sutures are usually required in this area. The denture is then inserted and the occlusion checked, and the peripheral borders are observed to determine that they are not overextended, since irritation and laceration may result, causing unnecessary pain and swelling. Some operators prefer to use a surgical paste or an adhesive powder for the final insertion of the denture. This technic is optional.

ABNORMAL MUSCLE ATTACHMENTS AND HYPERTROPHIED TISSUE

Abnormal muscle attachments and fibrous tissue attachments should be remedied at the time of insertion of the denture. It is preferable not to cut these attachments, as scar tissue will then be formed in the valve-seal area of the jaw. An incision is made on the crest of the ridge and the attachment, including the periosteum, is freed to permit retraction of the tissue toward the mucobuccal fold. The denture, when inserted, will hold the tissue in its new position. The blood clot formed in the space created on the crest of the ridge undergoes organization, and healing follows. Flabby and hypertrophied tissue can sometimes be removed by simple excision. When it is more extensive, a wedge of tissue is removed and sutures are placed.

POSTOPERATIVE INSTRUCTIONS

Detailed instructions should be given the patient regarding postoperative care and diet. He is told not to remove the denture under any circumstances, and is instructed to return in forty-eight

hours, at which time the denture is removed, the mouth is given postoperative care and any necessary adjustments in the denture are made. The day of the operation, intermittent application of ice packs is advised and a sedative is prescribed for pain. The following day, hot moist applications are indicated.

The physical discomfort following this operation is greatly minimized by a buoyant state of mind. The patient invariably feels that much has been accomplished in a short time and with a minimum of discomfort. When he returns for treatment, and for the first time is given the opportunity to close down upon edentulous jaws, he fully realizes what a priceless possession he has in the immediate denture.

CONCLUSION

Surgical preparation of the mouth and immediate insertion of dentures is a comparatively new field. The pioneering days, however, are past. The brief transitional period and cosmetic possibilities have created a demand for this type of prosthesis. Careful diagnosis and a well-arranged plan of procedure, combined with the advantages offered by the new denture materials, can only result in an exceedingly satisfactory and pleasing service to the public.

At the present time, the dentists enlisted in our armed forces are facing a real challenge in immediate prosthesis. In the rehabilitation of war casualties, in which face and jaw injuries have been sustained, the dentist skilled in all phases of immediate denture construction and endowed with personal ingenuity can be of invaluable service. The contour and expression of the face are dependent on the condition of the structures supporting the soft tissues. There will be many facial injuries in which an immediate prosthesis will become the substitute for the substructure of the face and jaws and will control the contraction of the soft tissues. Such appliances will be indispensable to successful plastic operations later and will prevent major deformities in facial contour. With a well-grounded knowledge of immediate replacements, the dental profession will lead the way to new and greater achievement in the art of surgical prosthesis.

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A SCIENTIFIC METHOD OF ESTABLISHING NORMAL VERTICAL DIMENSION

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DYSFUNCTION of the temporomandibular joint is and has been a problem to the dental as well as the medical profession, and of greater concern to those patients seeking relief. Until recent years, independent research into the causes and effects of dysfunction were conducted by the medical and the dental profession, each seeking a remedy without recourse to the findings of the other. But the problem, assuming the proportions that it did, succeeded in bringing together the two professions, and the resultant contact has been to the benefit of all concerned.

The types of dysfunction of the temporomandibular joint are many, some real, some imaginary, but all worthy of keen study and investigation. Arthritic changes are visible, fixation, fracture, dislocation and subluxation, but the only pathologic conditions to be considered here result from dysfunction due to dental conditions, such as closed bite in edentulous cases, loss of molar support and unbalanced occlusion.

Let us consider the practical aspects of the problem as viewed by the otologist. There is much of theory and speculation, based on anatomic and neurologic study, that attempts to explain the various reflex paths involved in the production of the different types of pain associated with dysfunction. Since it is obvious that all unilateral pain in the region of the ear cannot be referred to a dental or medical consultant, some criteria for a practical clinical approach must be organized.

Since it is so apparent, the underlying pathologic process will be only superficially reviewed.

If there is little or no molar support, tremendous strain is placed on this complex joint, and the resultant damage to its articular surfaces is inevitable; yet this may amount to an erosion only of the cartilage of the joint, with consequent pain of various degrees. The bony condyle itself may be eroded, and, if further neglected, the lesions can extend through the posterior wall of the joint cavity, even penetrating the bony wall of the external auditory canal. This factual finding is demonstrated by several specimens collected by the Politzer Museum and those of the Royal College of Surgeons, showing this extremely extensive form of erosion.

Walter T. Hotchkiss reports a case admitted to the clinic at Ann Arbor, Mich., in which the patient complained mainly of a loud noise in the ear that was present while he was eating. The case was edentulous, and the condyle had eroded posteriorly, what was left of the temporomandibular joint cavity being forced backward until it was in open communication with the external auditory canal wall. When the patient opened his mouth, air was sucked from the ear canal into the joint cavity through a fistula in the anterior canal wall; while, with closure of the lower jaw, air was forced out. Although an observer could hear this interchange of air, the sound was much louder to the patient. An attempt to close the fistula in the canal by use of a plastic flap was unsuccessful.

At that time, little or no attention was given to establishing the normal vertical dimension, yet Dr. Hotchkiss believes that had proper dentures been

made for the patient and had the condyle been allowed to resume its normal position, the fistula would have closed of itself.

Figure 10 shows the distribution of the fifth nerve and areas supplied by it.

The posterior displacement of the condyle, even without marked erosion, compresses the soft tissue of the supporting structure, and often affects the nerves in the immediate area. The auriculotemporal nerve, a branch of the mandibular, lies close enough to occasionally be impacted by a displaced condyle, and this impaction initiates stimuli along its own fibers, as well as the other two

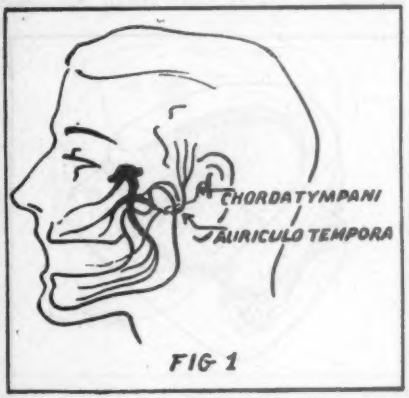

Fig. 1.—Open position of mandible, which has no effect on auriculotemporal and chorda tympani nerves.

branches of the mandibular nerve; namely, the lingual and the inferior alveolar.

The chorda tympani is occasionally compressed and unusual taste sensations on the tongue, as well as salivary gland upsets, have been ascribed to this situation.

The backward displacement of the condyle stretches the capsular ligaments, and James B. Costen[1] believes that the eustachian tubes can be secondarily compressed by these surrounding tissues.

1. COSTEN, J. B.: *Ann. Otol., Rhin. & Laryn.*, 43:1, March 1934.

Consider the position of the otologist who attempts to advise a patient with one or more of the symptoms outlined below, as to what course to pursue, the usual ear, nose and throat causes having been ruled out.

1. Impaired hearing, continuously or with intervals of improvement.[1]

2. Stopping or stuffy sensation in ears, very definite about meal time.

3. Tinnitus, usually "low buzz" in type; less often, a snapping noise in chewing.

4. Pain, of the dull type, within and about the ears.

5. Dizziness, mild, and again attacks

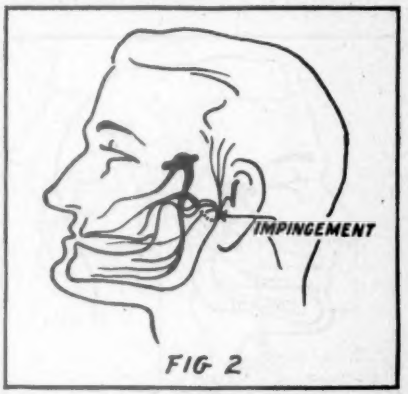

Fig. 2.—Mandible closed beyond normal vertical dimension. The condyle moves backward against the posterior wall of the fossa.

of prostrating severity definitely relieved by inflation of eustachian tubes.

6. Alleged "sinus" symptoms: headache, localized to vertex and occiput and behind the ears.

7. Burning sensation in throat, tongue and side of nose.

If any of the foregoing group of symptoms is found in patients with loss of molar support, edentulous mouths or unbalanced occlusion, the otologist should call a dentist in for consultation, and these conditions may be diagnosed by:

1. Lack of molar support or badly fitting dentures, permitting loss of vertical dimension.[1]

2. Mild catarrhal deafness, improved temporarily by inflation of eustachian tubes.

3. Dizzy spells, relieved by inflation of tubes.

4. Tenderness to palpation of mandibular joints.

5. Marked comfort to patient from interposing a flat object between posterior teeth or jaws.

6. Presence of typical headache after sinus or eye involvement has been corrected and found to be negative.

7. X-ray study of the temporomandibular joint, to determine the position of the condyle within the fossa.

Assuming that a consultation between the otologist and dentist results in finding the patient to be edentulous, with a closed bite, complaint of pain within and about the ears and dizzy spells, with an occasional stuffy sensation in the ears, the otologist would diagnose the case as one calling for inflation of the eustachian tubes, and should this inflation relieve the dizzy and stuffy sensation, it is apparent that the closed bite has allowed the muscles of mastication to lose their tone and crowd the eustachian tubes. This crowding closes the tubes so that the air which normally passes through the tubes to the middle ear is closed off and an equalized pressure cannot be maintained, with the result that the dizzy and stuffy symptoms occur. The pain within and about the ears is accounted for by the posterior displacement of the condyle in the fossa, causing impaction of the auriculotemporal nerve, the terminal branches of which supply these areas.

The treatment for this case is construction of well fitting dentures and establishment of the normal vertical dimension.

No particular method for impression taking will be described, but it is imperative to follow a good impression technic to insure well fitting dentures.

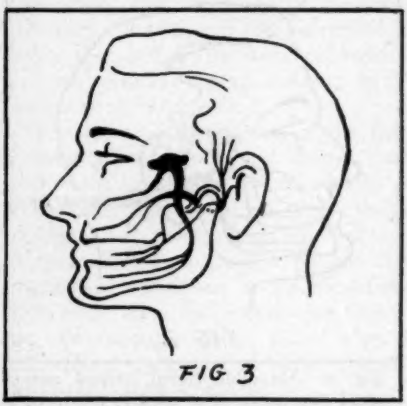

Fig. 3.—Mandible in normal vertical position. There is no impingement on the auriculotemporal and chorda tympani nerves.

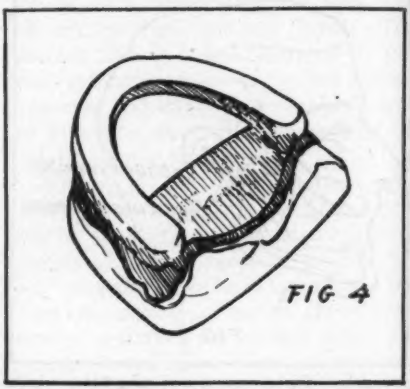

Fig. 4.—Flat metal plate, which is fixed on palatal surface of upper biteblock in establishing normal vertical dimension.

Assuming, therefore, that satisfactory impressions have been secured, models poured and good biteblocks constructed, the next important step is to establish the normal vertical dimension.

Figures 1, 2 and 3 illustrate three positions of the mandible, open, closed and normal, and the relation each position of the condyle bears to the condyle fossa, maxilla and nerves.

Figure 1 shows the open position of the mandible, which has no effect on the auriculotemporal and chorda tympani nerves.

As the mandible closes beyond the normal vertical dimension, the condyle moves backward against the posterior wall of the fossa. (Fig. 2.) Thus, the posterior displacement of the condyle causes an impingement on the auriculotemporal and chorda tympani nerves, resulting in pain within and about the ears and a burning sensation in the throat, tongue and the side of the nose. A metallic taste and salivary gland upsets are ascribed to irritation of the chorda tympani nerve.

Figure 3 shows the mandible in the normal vertical position. The condyle is in its normal position in the fossa, with

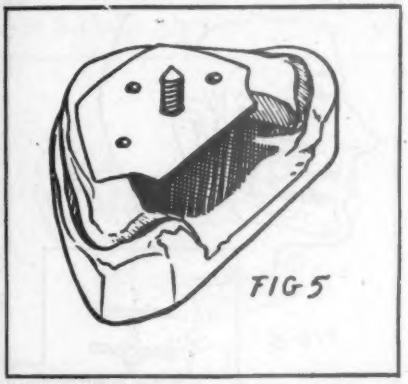

Fig. 5.—Metal plate with central bearing screw near center. This plate is mounted on the lower bite-rim.

no impingement on the auriculotemporal and chorda tympani nerves.

The normal vertical dimension is established by the following method: A flat metal plate is fixed on the palatal surface of the upper biteblock. (Fig. 4.) A metal plate with a central bearing screw near the center is mounted on the lower bite-rim. (Fig. 5.) These are then placed in the patient's mouth, as shown in Figure 6.

The mandible is held in the open position by the central bearing screw of the lower bite-rim in contact with the flat metal plate of the upper. (Fig. 6.) The patient is instructed to hold the point of the screw against the metal plate of the upper and move the mandible to the right lateral, left lateral and protrusive positions several times. This series of movements records a gothic arch tracing on the upper metal plate whereby centric occlusion is established with the "bite" in this open position. The condyle is in a forward position within the fossa. On removal of the biteblocks from the mouth, a small round hole is cut at the junction of the lines forming the gothic arch tracing.

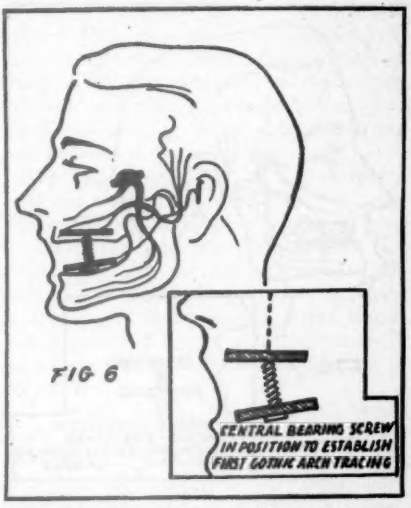

Fig. 6.—Plates (Figs. 4 and 5) in position in mouth.

The upper biteblock is returned to the patient's mouth, with attention to the hole cut at the apex of the gothic arch tracing on the upper metal plate. (Fig. 7.) The central bearing screw of the lower bite-rim is lowered until the bite is closed. The lower bite-rim is placed in the mouth and is checked to determine whether the point of the screw has moved forward from the hole on the upper plate. The patient is asked to record a gothic arch tracing, to insure that the jaw is not being protruded by mis-

take. By lowering the screw, we have closed the bite, because the point of the central bearing screw has moved forward from the hole, as shown in Figure 7.

Figures 7 and 8 show the two extreme positions of the condyle in the fossa. (Fig. 7, open; Fig. 8, closed.) Somewhere between these two extremes is the position that the condyle assumes when in its normal relationship with the fossa. The next step describes the final procedure in placing the condyle in its normal position in the fossa.

The lower bite-rim is removed and the central bearing screw is raised one turn and returned to the mouth, the patient registering a gothic arch tracing by the central bearing screw rubbing against the upper metal palatal plate, to insure that the mandible is in its most retruded position. This operation is repeated, each time raising the screw one turn, until the point of the screw reengages itself in the hole of the upper metal palatal plate. The instant that this is accomplished, the normal vertical dimension is established, as well as centric occlusion.

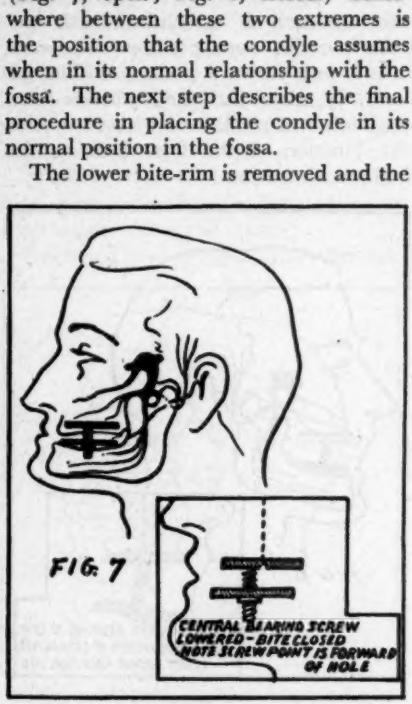

Fig. 7.—Upper biteblock in mouth. It is placed with attention to the hole cut at the apex of the gothic arch tracing on the upper metal plate. The condyle is here in the open position.

The "bite" is locked in this correct position by the use of a Stansbery plaster gun. Soft plaster is injected between the bite-rims of the upper and lower models which hold the metal plates. The plaster is forced so that it will flow between these two plates. The plaster will lock the point of the central bearing screw in its centric position and retain the normal vertical position which has been established. The plaster is allowed to harden and the biteblocks are removed from the mouth. The upper and lower casts are placed in the biteblocks and the case is mounted on an adjustable articulator, with the usual routine to complete the dentures.

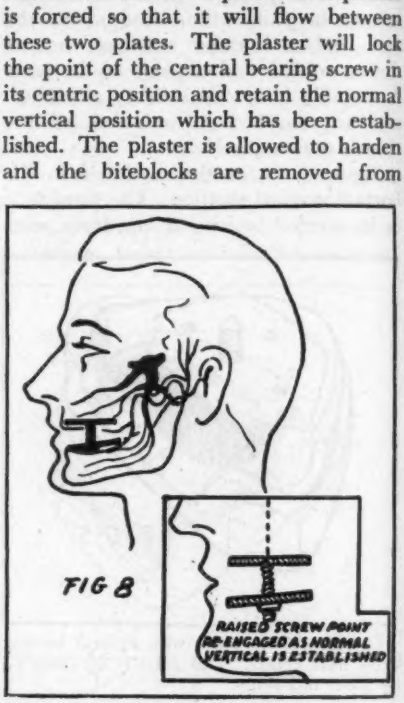

Fig. 8.—Closed position of condyle in fossa.

The finished dentures are placed in the patient's mouth. Thus, the normal vertical dimension is definitely established, and the secondary effects of the closed bite, such as compression of the eustachian tubes, effects of erosion and of pressure on the auriculotemporal nerve, will be relieved almost immediately. These results are based on the fact that

the jaws are restored to their correct relationship, and the condyle resumes its normal position in the temporomandibular fossa.

The wearing or grinding away of the occlusal surfaces of the natural teeth may produce the same abnormal conditions and symptoms as those that have already been described. The treatment of such cases is restoration of this lost tooth structure by building up the occlusal surfaces of the teeth. Extreme care should be used in these cases, and a safe plan is to establish normal vertical dimension by constructing a splint as illustrated in Figure 9. This splint should be worn by the patient until convincing improvement has taken place and the newly established vertical dimension is correct and comfortable for the patient. This being evident, the dentist may then decide on the type of permanent work necessary for completion of the case.

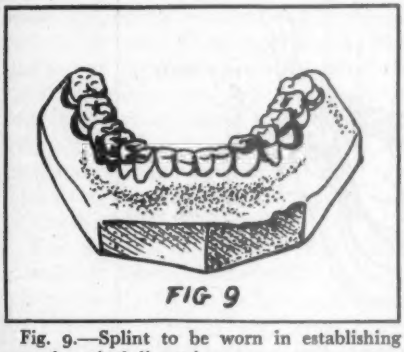

Fig. 9.—Splint to be worn in establishing normal vertical dimension.

REPORT OF CASES

CASE 1.—L. W. L., a man, aged 48, first examined March 20, 1941, because of attacks of dizziness so severe that, during an attack, he had to hold onto something to keep from falling, reported that relief was obtained only by having the eustachian tubes inflated, which was sometimes not possible. His physician, he stated, could not lay these attacks to a slightly increased blood pressure. At the time of the present examination, the patient was on leave of absence from his work in an effort to prevent a nervous breakdown.

Examination revealed that the patient had worn upper and lower dentures for five years. For the past two years, the dizzy spells had occurred three or four times a day. The bite was closed, and this fact was connected with the history of relief from inflation of the eustachian tubes. The patient was advised to have a new lower denture made, in order to reestablish the normal vertical dimension. This was done and the dizzy spells ceased within three or four days. There have been no attacks since and the nervous condition has cleared up.

CASE 2.—Mrs. G. M., aged 55, first examined May 26, 1942, complained of pain in the right mandibular joint, a burning sensation on the right side of the tongue, headache and a snapping noise in both ears. There was swelling on the right side of the face in front of the mandibular joint.

The upper teeth had been extracted in 1930 and a denture inserted one month later, The lower teeth had been extracted in 1935, but a denture was not inserted until two years later. For the past three years, the pain in the mandibular joint had increased in severity, at times being so severe that it was necessary for the patient to insert a folded handkerchief between the dentures to get relief.

A normal vertical dimension was established by means of new upper and lower dentures. The pain in the temporomandibular joint and burning of the tongue were relieved immediately. The patient still complains of snapping noises in both ears, but says that the condition is improving.

CASE 3.—Mrs. T. B. M., aged 57, first examined June 5, 1940, complained of pain in both mandibular joints and dryness of the mouth. Fissures were constantly present in the angles of the mouth. The patient had no appetite owing to inability to masticate with her dentures, which did not fit properly. She had worn dentures for thirty years. The bite closed in an extreme degree.

New dentures were made and the normal vertical dimension was reestablished. The pain in the joints cleared up immediately. The saliva resumed its normal flow in about ten days. The disturbance of the salivary gland function was due to pressure of the

condyle on the chorda tympani nerve. The fissures at the angles of the mouth disappeared in about two weeks. This condition was believed by clinicians to be due to a riboflavin deficiency, probably brought about by lack of desire for food and inability to masticate properly. The patient reported that the new dentures were comfortable and that she was enjoying eating.

CASE 4.—G. T. W., aged 36, a physician, complained of pain in the left temporomandibular joint. An x-ray examination of the joint revealed erosion of the left condyle and posterior displacement of the condyle in the fossa. The right condyle showed no erosion, but was displaced posteriorly in the fossa. All of the upper and lower teeth were in place. There was an end-to-end bite and the enamel of the occlusal and incisal surfaces of all the teeth was worn through, the dentin, which was exposed, being extremely sensitive. The wearing down of the enamel had resulted in closure of the bite. The combination of mouth discomfort and pain in the mandibular joint caused extreme nervousness. The patient had not been able to practice for six months.

The teeth were restored to normal by complete rebuilding. During this period, of one month, temporary acrylic splints were worn by the patient to cover the sensitive teeth. By the time that the permanent work was completed, the symptoms had disappeared, as the result of correction of the vertical dimension by means of the temporary splints. The normal vertical dimension was established with completion of the permanent restoration. The patient reported six months later that he was free from discomfort.

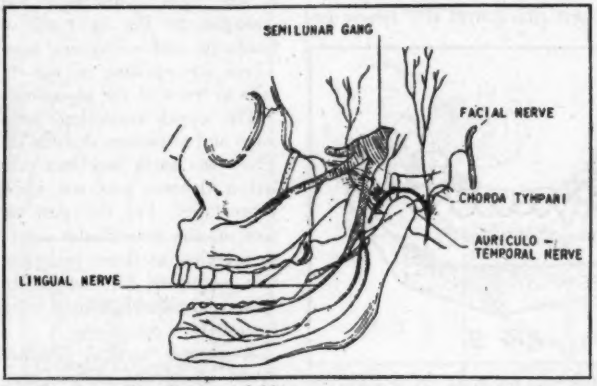

Fig. 10.—Distribution of fifth nerve and area supplied by it.

CONCLUSIONS

1. Dysfunction of the temporomandibular joint can be diagnosed, and it can be demonstrated that closed bite, loss of molar support and unbalanced occlusion are responsible for the pathologic conditions arising from these conditions.

2. When the bite is closed from occlusal wear on the natural teeth, the use of a temporary splint may be important in diagnosis.

3. The pathologic mechanics responsible for the temporomandibular joint disturbances can be corrected by use of an accurate method of determining the correct vertical dimension.

4. The symptoms that are the result of temporomandibular joint disturbances can be relieved by establishing the normal vertical dimension and balancing the occlusion.

SOME FACTORS CONCERNED WITH THE INCIDENCE OF DENTAL CARIES IN CHILDREN:

MULTIPLE PREGNANCY, AND NUTRITION DURING PRENATAL, POSTNATAL AND CHILDHOOD PERIODS

HAROLD BERK,* D.D.S., Boston, Mass.

IN the Medical-Nutrition Department of the Forsyth Dental Infirmary, there is a large accumulation of full case histories. It seemed that a statistical survey of this material might yield some interesting information on the incidence of caries in young children. This study was made with special reference to the effect of multiple pregnancy on the incidence of caries, as well as the effect of some phases of feeding in the prenatal period and in infancy, the childhood diseases and the present diet of the child.

For the first purpose of the study, namely to determine the effect of multiple pregnancy on the incidence of caries in children, several facts were established: (1) the age of the child, (2) the position of the child in the family and (3) its social environment. First, the age of the child was standardized in order to have had the teeth subjected to their environment for the same length of time and also to have the same number of teeth present in each case. Secondly, the children were divided into two groups according to their position in the family: those who were first-born and those who were fourth-born or later. Only those children whose parents are unable to afford private dental care are eligible for treatment at the Forsyth Dental Infirmary. Thirdly, then, a basis of financial equality was established, all the children available for this study being of the low income levels.

Only those records were used that were complete with regard to the following data: (1) the history of the prenatal, postnatal and early infancy periods, (2) a chart of all oral manifestations and (3) the nutritional history, including past and present dietary habits.

The 5-year-old child was chosen as a constant after a survey had been made of the records of the Medical-Nutrition Department of the Infirmary. Mothers are able to give a more accurate history of the prenatal, postnatal and early infancy periods of children of this young age than of older children. Also, the entire deciduous dentition consisting of twenty teeth is normally present. Although the first permanent molars and central incisors were present in the mouths of some 5-year-old children, these teeth were not included in this study. Any missing deciduous molars and cuspids were considered as being involved teeth. Since roentgenograms were not available for all children, the decayed, missing and filled teeth were noted rather than the surfaces involved.

The dental examination, included in the records of the Medical-Nutrition Department, had been made in the usual manner, with mirror, explorer and air

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syringe. The following had been recorded: carious teeth, hypoplasia, abrasion, etching, poorly calcified areas, form of the arch, height of the vault, condition of the gingivae and mucous membranes, spacing of the teeth, missing teeth and oral hygiene.

The nutritional history had been taken by experienced nutritionists in the Medical-Nutrition Department and the present diet carefully recorded and analyzed. These diets had been graded as good, fair or poor, the grade depending on the intake of protective foods.

With the above information at hand, the statistics were compiled in the following order: position of the child in the family, number of carious teeth, sex, mother's intake of milk during gestation, length of time breast-fed, length of time bottle-fed, age at which administration of cod-liver oil was begun and length of time continued, early illnesses and present diet.

For this study, the records of all the 5-year-old children in the files of the Medical-Nutrition Department were reviewed and 198 cases were found to fulfil the three requirements outlined above. A survey of the dental records showed that caries was present in 94 per cent of the 198 children examined. The high incidence of caries in young children has been noted by other investigators.[1, 2, 3, 4] Statistics from the Guggenheim Clinic show that as many as 99 per cent of the 5-year old children examined had dental caries.[5]

TABLE 1.—PERCENTAGE OF FIRST AND LATER CHILDREN IN EACH GROUP

	Group I (33 Children) Percentage Having Five or Less Carious Teeth	Group III (38 Children) Percentage Having Fifteen or More Carious Teeth
First children	16.0	13.2
Fourth or later children	17.3	26.0

Data available in the literature differ as to the relative susceptibility to caries of the two sexes.[1, 6, 7] The percentage of caries was not computed in this study, but the average number of teeth affected with caries was compared. The male group had an average of 9.66 teeth affected with caries; the female group, an average of 9.70. This difference is apparently negligible and is in accordance with the findings of Klein and Palmer.[6]

In the 198 cases in this study, 106 children, designated as Group I, were first-born in the family, and ninety-two children, designated as Group II, were fourth-born or later in the family. Group I had 935 teeth affected with caries, or an average of 8.82 teeth for each child. Group II had 959 teeth affected with caries, or 10.42 teeth for each child. The average number of teeth affected with caries in both groups was 9.6 of 48 per cent of all the teeth present, which appears to be high for this age group. J. Sim Wallace,[8] citing statistics from the health reports for the Cambridge Borough in England, shows that, in 1917, 38 per cent of the deciduous teeth of 5-year old children were carious.

TABLE 2.—COMPARISON OF MOTHERS' INTAKE OF MILK DURING GESTATION

	Group I Percentage of Mothers	Group III Percentage of Mothers
3 to 4 glasses daily	64.0	34.3
1 pint daily	9.0	21.0
Less than 1 pint daily	15.0	21.0
Amount negligible	9.0	23.7
Data unavailable	3.0	0.0

The difference existing between Group I and Group II is 1.60 carious teeth. The standard deviation was found to be 0.758. With the figure 0.758 as the divisor and 1.60 (the difference existing between the two groups) as the dividend, the quotient is 2.11. This figure is on the borderline of statistical significance. Since the number of decayed teeth in both groups ranged from none to twenty,

the biologic significance of this difference is slight. (The statistical significance of this finding was determined by Miss Jane Worcester, associate in the Department of Vital Statistics, Harvard School of Public Health.) The great number of factors in dental caries leads one away from the exclusive consideration of any single factor such as the effect of multiple pregnancy on caries and toward reflection on the problem in a broader aspect.

To determine what may have been the reasons that some children were caries free while others suffered the ravages of decay, further comparisons were made. The group of 198 children was reclassified. Since 9.6 was the average number of affected teeth in this study, it is reasonable to consider five or less teeth affected with caries as good; fifteen or more as poor. Therefore, this classification divided the children into three new groups: (1) those having five or less carious teeth, (2) those having six to fourteen and (3) those having fifteen or more. Thirty-three, or 16.6 per cent, of the children comprised Group I; thirty-eight, or 19.1 per cent, comprised the other extreme, designated as Group III. These two extremes served as the basis of comparison for the remainder of the study.

TABLE 3.—COMPARISON OF ADMINISTRATION OF VITAMIN D SUPPLEMENT IN TWO GROUPS OF CHILDREN

	Group I Percentage	Group III Percentage
Regular administration throughout entire life	39.0	13.2
Regular administration in winter	27.0	15.8
Administration in very early childhood only	15.0	50.0
No vitamin D supplement	18.0	21.0

In this classification, 16 per cent of first-born children and 17.3 per cent of later-born children fell into Group I, whereas 13.2 per cent of first-born children and 26 per cent of later-born children fell into Group III.

It is apparent, then, that later-born children are as likely to have good teeth as first-born children. The difference existing between first-born and later-born children has been shown to be on the borderline of statistical significance so far as multiple pregnancies are concerned. The difference existing between the two groups is more definitely shown with the comparisons made in Group III. Since a larger number of later-born children than first-born children fell into Group III, several factors in dental caries must be considered. Aside from the intrinsic and local factors, environmental conditions may play an important part.

TABLE 4.—DIETARY RATING ON BASIS OF FIVE IMPORTANT FOOD GROUPS*

	Poor							Fair			Good	
	1	1½	2	2½	3	3½		4	4½	5	5½	6
Group I Good Teeth (5 or less carious teeth)	0	0	0	0	0	1		1	5	7	12	2
Group III Poor Teeth (15 or more carious teeth)	1	2	3	5	5	5		1	6	5	2	1

*Seven dietary records were found to be incomplete and were, therefore, omitted from this part of the study.

If the family income is fixed, the birth of each additional child lowers the per capita income. It seems obvious, then, that this would, in turn, lower the allotment that could be spent in feeding and caring for each individual child. This assumption has been sustained by the findings of other investigators. Miller and Crombie[9] also found that those having the worst teeth were often the younger children of large families. Such a tendency was shown by Burke,[10] at the Harvard School of Public Health, and by Sognnaes and White,[11] at the Forsyth Dental Infirmary for Children.

The considerable contrast in the number of teeth affected by caries previously noted in Groups I and III led to a closer study of relative causes.

Much stress has been laid upon the prenatal period. However, investigations made by Schour,[12] Kronfeld[13] and others show that calcification of the teeth is likely to take place at the expense of the mother, regardless of the dietary and prenatal histories. It was not until recently that a satisfactory explanation was offered correlating poor prenatal histories and poor dental conditions. Massler, Schour and Poncher,[14] in studying the calcification pattern of teeth, found that, up to the time of birth or the neonatal period, calcification is homogeneous. From the time of birth to 10 months, calcification is poor. It is within this period that hypoplasia usually occurs. Schour suggests that it is necessary for a child to have a sufficient calcium reserve to carry him through this crucial period, in order to prevent poor calcification of the tooth structure and hypoplasia.

TABLE 5.—EVALUATION OF PRESENT DIET OF THE CHILDREN OF TWO GROUPS

	Group I Good Teeth*	Group III Poor Teeth†
Good	50.0	8.5
Fair	46.4	33.3
Poor	3.6	58.4

*5 or less carious teeth.
†15 or more carious teeth.

It is reasonable to assume that, through an adequate prenatal diet of the mother, a sufficient calcium reserve can be acquired by the infant to carry him through this shock or change in life.

The National Research Council[15] recommends daily during pregnancy 1.5 gm. of calcium, a figure nearly twice as high as that suggested for the non-pregnant adult. Burke[16] and others,[17] recommend that, in order to assure meeting this requirement, a quart of milk be taken daily. It has been shown that calcium supplied naturally in milk and food is assimilated to a greater degree than medicinal calcium.[18]

This recommendation was used as a basis for Table 2, which compares the mothers' intake of milk during the prenatal period in Groups I and III. Considerable difference was found to exist in this aspect. It will be noted that the consumption of milk by mothers of children in Group I was significantly higher than that of those in Group III.

Burke's[16] findings are also suggestive that the amount of milk in the prenatal diet may be of importance with respect to the deciduous teeth.

The cases were reviewed to determine whether breast feeding has any effect upon the incidence of caries in children. No significant difference was noted. Day and Sedwick[1] studied the relationship between breast-feeding and the incidence of caries and reported that, "complete statistics on breast feeding in 370 cases indicate that breast-fed children showed scarcely less caries incidence than those artificially fed in infancy." Martha Jones,[19] in studying Hawaiian children of the laboring population, who are universally breast-fed for a year and often longer, showed that, in a group of sixty-four babies, sixty-one, or 95 per cent, had decayed teeth before the age of 15 months. Of the 576 teeth that were erupted, 265, or 46 per cent, were carious.

In spite of the fact that, in the present study, no direct relationship was observed between breast feeding and the incidence of caries, it is undoubtedly true that breast feeding exerts a favorable influence on jaw formation and strengthens the muscles of the face and throat.

Vitamin D has long been considered an important factor in calcium metabolism. May Mellanby[20] has done much work in this field and has shown that poor calcification of the teeth results from a lack of this vitamin.

This concept was upheld in this study, in that 39 per cent of the children in Group I, as compared with 13.2 per cent of those in Group III, received cod-liver oil regularly throughout the entire year up to 5 years of age.

It is questionable whether a vitamin D concentrate is necessary throughout the entire year. It is believed that the child who is out-of-doors during the summer months does not need that additional fortification. Thus, those children who had cod-liver oil regularly either throughout their entire life or in all the winter months can be recognized as having had an adequate supplement. Therefore, 66 per cent of Group I, as compared with 29 per cent of Group III, were adequately fortified. The administration of a vitamin D supplement in the two groups is further compared in Table 3.

The occurrence of infectious diseases and other illnesses was tabulated in order to determine whether they exerted any influence on the incidence of caries, but no difference was found. One child who had had six illnesses, namely mumps, whoopingcough, scarlet fever, measles, chickenpox and repeated attacks of bronchitis, fell, nevertheless, into Group I. This observation is in accord with investigations made by Sognnaes and White[10] and Thelander.[21]

The present diets, which were taken at the time the records were made, were next rated by a nutritionist in the Medical-Nutrition Department. (Dietary ratings were made by Mrs. Helen R. Berk, assistant, Nutrition Department, Forsyth Dental Infirmary.) An arbitrary rating scale was set up and values assigned to five important food groups (milk, citrus fruit, vegetables other than potato, whole grain cereal and egg), each receiving a score of 1 point, except milk, which was assigned 2 points. On this basis, the habitual intake of each child was assigned a total value so that the relative adequacy of the diet could be expressed in one figure. An arbitrary division was made so that the total rating of 5½ to 6 was considered good, 4 to 5 inclusive as fair and below 4 as poor. It is interesting to note (Table 4) that only one child with good teeth had a poor rating and received a score of 3½, whereas the majority of children having poor teeth had ratings of 3½ or lower.

From the data in Table 4, the following percentages were computed. Fifty per cent of the children of Group I, as compared with 8 per cent of those of Group III, were rated as good. Four per cent of those of Group I, as compared with 58 per cent of those of Group III, were rated as poor. Further comparisons are given in Table 5.

The findings in Table 5 represent the most striking difference between the two groups, seeming to indicate that the state of nutrition and the occurrence of dental caries are closely correlated. Several investigators uphold this view.[22]

SUMMARY

The case histories of 198 5-year old children were studied to determine the effect of the following conditions on the incidence of caries: multiple pregnancy, certain phases of feeding in pregnancy and infancy, childhood diseases and the present diet.

One hundred and six children were first-born and were designated as Group I. Ninety-two children were fourth-born or later and were designated as Group II. The difference in the number of teeth affected by caries was 1.6, which, although on the borderline of statistical significance, indicates that multiple pregnancy is not an important factor in caries.

The 198 children were then redivided into three groups: namely, those having five or less teeth affected with caries, those having six to fourteen and those having fifteen or more. Groups I and III were further compared in an effort to determine the causes of these extreme

differences. The following were found to be significant: the mothers' intake of milk during gestation, the presence of a vitamin D supplement in the child's diet and the child's dietary habits at the time the records were made.

No significant difference was found to exist in caries susceptibility between the sexes. Breast-feeding and early illnesses were found to exert little influence on dental caries.

CONCLUSIONS

1. The occurrence of multiple pregnancy *per se* is a relatively unimportant factor in the incidence of dental caries.

2. An adequate prenatal diet seems to be an essential factor in the calcification of the child's teeth during the first ten months of life.

3. The present diet seems to be the most significant single factor in dental caries.

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THE JOURNAL *of the*
AMERICAN DENTAL ASSOCIATION

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November 1 — *Editorial Department* — 1943

AUTONOMY OF DENTISTRY

FROM the very inception of dentistry as a specialty of the healing art separate from medicine, one of the uppermost objectives in the mind of dentistry has been to impel the medical profession to recognize dental practice as a branch of the healing art worthy of its cooperation and collaboration, to the end that the health of one of the most important organs of the body might not be neglected as a factor in general bodily health. Lack of such recognition and consideration was the very reason for the establishment of dental practice as a distinct health service and for the development of the educational system built up around it, which has had for its object the training of men in the care of the mouth and its contained organs.

The experience of dentistry in the effort to preserve its rights and privileges and, at the same time, maintain its dignity and self-respect in the present war effort has been to emphasize more intensively the necessity and desirability of an even more distinct autonomy than at present exists.

And yet there remain some in the dental and medical professions who

would have us abandon a system of practice and preparation therefor that has proved eminently successful almost from its inception.

This, we believe, is but the recrudescence of an educational trend of some two decades ago, which eventuated in the survey of professional dental education in the United States conducted by the Carnegie Foundation for the Advancement of Teaching and the subsequent survey made by the American Association of Dental Schools. Both of these projects had for one of their objectives the determination of the desirability of consolidation and coordination of dental with medical education. The two projects arrived at the same inevitable conclusion; namely, that the two objectives, dental education and medical education, could best be attained by separate and individual approaches.

Those in the medical profession who still favor consolidation of educational effort are, of course, of the opinion that the dental aspirant should pursue the full medical course and then specialize educationally for the dental specialty, as is the case in various other medical specialties. It has, however, never been made quite clear to the dental educator that all medical knowledge is necessary as a foundation for the pursuit of the dental degree. We do not believe it necessary to know all that is taught in the medical school on such subjects as obstetrics, gynecology and brain surgery, for instance, to become a good dentist; in fact, we believe that the time and energy necessary for the attainment of that and much of the other special education is or, rather, would be a definite deterrent if not a serious handicap to the dental aspirant. The time required for the pursuit of what we believe to be extraneous subjects, at least so far as dentistry is concerned, can much better be employed in acquiring a knowledge of desirable and specific dental subjects, or subjects more adaptable to the attainment of dental knowledge.

We believe also that the four years of professional study devoted to the acquirement of education for a definite specialty is much more valuably and practically employed than the same amount of time devoted to an effort to acquire knowledge of every phase of medicine and surgery. It is for that reason, other things being equal, that we believe the dental initiate is far better prepared to practice his specialty at the completion of his special educational preparation than is the medical graduate who has had to divide his time among several efforts.

All the foregoing is offered as justification of the practice of dentistry as a separate, autonomous entity of the healing art, an autonomy which really began or was practically established in the seventeenth century.

There are among our historians those who believe that the first organized efforts at dental education in this country originated with the foundation of the first dental school and that this act signalized the separation of dentistry from medicine. There are others who believe that specialized dental education in this country began much earlier than the foundation of the first dental college and that a group of Ohio dentists inaugurated the first dental specialized teaching effort in this country. Whatever, whenever and wherever the origin of the separational idea, it is quite apparent to us that the destiny of dentistry as a specialty separate from medicine was portended, if not determined, very early in the history of dentistry. It now remains for us to safeguard and strengthen our autonomy to the point where it will serve its full usefulness.

The desirabilities of so maintaining our autonomy have been variously and numerously indicated in the present war emergency. Probably the one most important at the moment and the one of most significant bearing upon our future is the relationship that dentistry will have to health service after the present war.

Now that we have determined our autonomous position, let it be understood that dentistry is *per se* an independent, self-sufficient, self-determining profession; that it deserves autonomy in its own right and that medicine should graciously respect that right.

Autonomous dentistry is an essential social service. It is a competent health service and it long ago proved itself an essential health service to the armed forces and to the public, with a scientific educational and clinical program that needs no readjustment to or further orientation with the medical program.

BRIGADIER GENERAL MILLS PROMOTED

WE are indeed pleased to announce that Brigadier General Mills, head of the Dental Corps of the Army, has been promoted to the rank of Major General. Such an unusual action is indeed an honor, marking a well deserved and signal recognition of the Dental Corps of the Army and its head.

BIBLIOGRAPHICAL

Applied Anatomy of the Head and Neck

By Harry H. Shapiro, D.D.S. Philadelphia: J. B. Lippincott Co. Price $5.50.

This work was written "in order that the dental student and the practitioner of dentistry may have a working knowledge of anatomy and may realize to the full its significance in their profession."

It consists of nine chapters, the subjects of which are presented in a concise style with due respect to their relative importance. To the consideration of normal anatomy, there is a generous addition of references to abnormalities and pathosis. The author courageously associates the latter with his opinion of their causes and refers the reader to the literature.

The second chapter is the contribution of Bernice L. Maclean, of the Department of Biological Sciences, Hunter College, New York, N. Y., the wife of the author. Dr. Maclean has conformed to the purpose for which this book was written in presenting an excellent chapter on the "Development and Growth of Oral and Associated Structures," from the dental point of view.

The chapter on the temporomandibular articulation is disappointing. Its opening paragraphs state that "the anatomy of the temporomandibular articulation is of utmost importance to the dentist, for it is related to the many problems concerned with occlusion." Then follows presentation of its anatomy and movements. Finally, these are all viewed from the standpoint of the surgeon. Its importance to the dentist in its relationship to the many problems of occlusion is ignored or played down by weakening understatements and opinions. This same attitude is reflected in the next chapter, titled "Structural Changes Due to Loss of Teeth." Here, emphasis is placed upon the dangers of impingement, overextension and attempts to reproduce youthful masticating mechanisms in older persons. This emphasis upon the difficulties and dangers of prosthesis, in place of leading the reader constructively along the path of anatomy to the rehabilitation of the temporomandibular articulation, the masticating mechanism and the teeth in the reestablishment of the normal anatomic structure, which this book so ably describes, is a disappointment in view of its promise.

Here is an anatomy that includes such subjects as interpreting the roentgenogram, the development of dentition and its congenital and acquired malformations, pain, anesthesia of the teeth and oral infection. This does fulfil its promise. It is a great help forward.

The chapter on "The Skull" describes its anatomy and anthropometry and appropriately considers the x-ray studies of the skull, the sinuses, the temporomandibular articulation and the teeth. This is an excellent chapter presenting important information from a scientific dental viewpoint.

The chapter on "Musculature of the Face and Jaws" also considers the influence of habit on development of the dentition, muscles that move the mandible and fractures of the mandible and maxilla.

The chapter on "Neuroanatomy" presents a condensed description of the nerves of the head and neck, a thorough consideration of the autonomic or sympathetic system and an excellent study of pain and local anesthesia. This chapter and the next, on "Blood Vessels, Lymphatics and Salivary Glands," are beautifully illustrated. The latter chapter considers anatomic aspects of dental infection, hemorrhage and surgery of the various parts of the oral cavity, tongue, lips and cheeks; also diseases, including osteomyelitis, cellulitis, Ludwig's angina, Vincent's infection, antral infection, syphilis, cancer and disease of the salivary glands.

The last chapter, on the subject of "Anatomic Considerations of War Surgery," is timely, discussing burns, bleeding, tracheotomy, gunshot wounds and facial prosthesis.

There are 173 illustrations of definite value to the text. One hundred and fifty references form a well selected bibliography.

This is an original, progressive textbook of value to students and practitioners. Its originality is in the selection of subjects in vari-

ous chapters. These are remarkable in their harmonious anatomic and practical relationship, as well as in their importance. This and general all-round excellency recommend the book to dentists and dental students. The need for a greater knowledge of dental medicine recommends it to physicians and medical students.

D. J. G.

First Aid.

By WARREN H. COLE, M.D., and CHARLES B. PUESTOW, M.D. Ed. 2. 333 pages. Illustrated. Price $3. New York: D. Appleton Century Co., 1943.

THIS useful volume is a complete exposition of the methods of administering first-aid treatment to an injured person and as such is likely to be useful to Red Cross groups and others concerned with Civilian Defense activities. Bandaging, carrying the patient, hemostasis and other important first-aid procedures are described and illustrated. Some portions of the text tend to exceed the scope of a first-aid manual for lay people (and this is assumed to be intended for lay consumption primarily, for, in several instances, the reader is admonished to call the physician if certain symptoms or complications are evident). The book is easily read and contains an abundance of useful information. It can be heartily recommended to those seeking a useful text in this field.

F. F. K.

The Dental Treatment of Maxillo-Facial Injuries.

By W. KELSEY FRY, M.C., L.D.S.; P. RAE SHEPHERD, L.D.S.; ALAN C. MCLEOD, D.D.S., L.D.S., and GILBERT J. PARFITT, L.D.S. Ed. 2. Cloth. 250 pages. Illustrated. Price 16 s net. Oxford, England: Blackwell Scientific Publications, Ltd., 1943.

THIS English volume on the care of fractures of the jaws is one of the simplest and clearest expositions of the subject seen in some time. The volume is based on the experience attained in treating casualties in a maxillofacial center and is entirely practical throughout. The various types of fractures are clearly defined and described and methods of treatment are outlined and discussed in a consecutive manner. A feature of the presentation is to divide all fractures into four categories: (1) horizontal favorable, (2) horizontal unfavorable, (3) vertical favorable and (4) vertical unfavorable. These terms, referring to the location and direction of the fracture line in relation to displacing muscle pull, simplify the discussion of each type of fracture from the standpoint of muscle dynamics. Another good feature of the book is the large number of line drawings which clearly illustrate the problems under discussion and the methods of treatment advocated. Laboratory technics useful in the construction of splints are described. The book is nicely printed on good paper and can be recommended to those desiring a useful handbook in this field.

F. F. K.

Operative Oral Surgery.

By LEO WINTER, D.D.S., M.D. Professor of Oral Surgery, New York University. Ed. 2. Cloth. 1054 pages. 1,121 illustrations. Price $12.50. St. Louis: C. V. Mosby Co., 1943.

THE second edition of this book by Dr. Winter has many of the characteristics of the previous edition. Several additions have been made to broaden the scope of the volume. Among these are a chapter on war wounds of the jaws and the use of pin fixation and skeletal traction in the treatment of fractures of the jaws. As before, the volume is profusely illustrated although the quality of certain of the pictures leaves much to be desired and many of the illustrations are reproduced more than once. As a pictorial description of certain of the diseases of the mouth and jaws, it may prove to be of interest to those desiring this type of information.

F. F. K.

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BUREAU OF PUBLIC RELATIONS

QUESTIONS AND ANSWERS ON THE CARE OF CHILDREN'S TEETH*

1. *Q. How many teeth does one have?*

A. Usually, two sets of teeth are acquired during one's lifetime: the primary, often called baby, deciduous or first teeth, of which there are twenty, and the secondary, or permanent teeth, of which there are usually thirty-two. In some persons, one or more of these teeth may be absent.

2. *Q. Why is it important to fill and keep the teeth of the first set?*

A. There are several good reasons why these teeth should be given the very best of care:

1. The child needs these teeth for chewing his food; and he cannot masticate thoroughly with decayed and infected teeth.

2. Growth and development of the jaws and face are often disrupted by the too early loss of the primary teeth. When a tooth is lost too early, the teeth behind it tend to drift forward into the space and an irregularity of the second or permanent teeth often results. The primary teeth, by maintaining the space, act as guides for the permanent teeth that succeed them.

3. Good care prevents toothache and possible infection.

3. *Q. What are the advantages of going to the dentist at frequent intervals instead of every two or three years?*

A. Regular and frequent visits to the dental office enable the dentist to discover new cavities at an early stage, as well as to find other signs of disease which, if left untreated, can do irreparable damage. Small cavities can be filled more quickly and inexpensively than large cavities. Early dental treatment may prevent pain and serious complications, as well as the loss of teeth, with resultant disfiguration.

4. *Q. Isn't it easier for a dentist to fill a child's tooth than an adult's tooth?*

A. The steps taken to fill a child's tooth are essentially the same as those taken in filling an adult's tooth. Generally speaking, primary teeth are really more difficult to fill because of the smallness of the tooth and the nearness of the pulp (nerve) to the outside surface of the tooth. In addition to this difficulty, the dentist has to work in a small mouth, in a patient who is frequently unable to hold his tongue still or to sit quietly for periods sufficiently long to prepare and place a filling.

5. *Q. Is it true that broken-down first teeth should not be extracted because the tooth will save the space for the permanent tooth?*

A. A healthy tooth is nature's space

* The growth of public interest in dental health has resulted in a marked increase in requests for information on different phases of the subject. To meet this demand, the Public Health and Education Committee, now a committee of the Council on Dental Health, has authorized the preparation of a series of articles in pamphlet form, each article to deal with one of the dental questions most frequently asked by the public.

The current article, "Questions and Answers on the Care of Children's Teeth," was prepared by a special committee, consisting of Florence B. Hopkins, Walter J. Pelton, C. R. Taylor, Allen O. Gruebbel and Alfred E. Seyler, of the American Society of Dentistry for Children. This article can be obtained in reprint form at a nominal cost by addressing the Bureau of Public Relations, American Dental Association, 222 E. Superior St., Chicago, Ill.

maintainer, but an infected tooth can be a menace to health, the adult's or the child's. A general rule is, "If the tooth cannot be properly treated and filled, it should be extracted."

6. *Q. Which is better, tooth paste or powder?*

A. The choice depends in a measure on individual likes or dislikes. Paste and powder are usually similar except for the material added to the powder to make it into a paste. Select one which bears the Seal of Acceptance of the American Dental Association.

7. *Q. Can one make his own tooth powder?*

A. Yes, a good homemade tooth powder can be made from one part of finely pulverized table salt and three parts of baking soda.

8. *Q. Does it do any good to take calcium (in tablet form) for one's teeth?*

A. According to certain authorities, the best form of calcium is that which comes from our daily diet. One authority states: "If every child got a quart of milk and every adult a pint daily, with a reasonably good selection of food for the rest of the diet, all the calcium and phosphorus requirements of normal nutrition would be met." By 12 to 16 years of age, in the average child, the formation of the crowns of the permanent teeth will have been completed. Once the teeth are formed, calcium is of no use to them, but it is still important for proper bone formation.

9. *Q. Does gum chewing help or harm the teeth?*

A. It is often said that gum chewing supplies needed exercise for teeth and jaws and provides healthful stimulation to the gums. There is no scientific evidence of the truth of this statement, but there is evidence that the sugar in chewing gum does contribute to dental decay in susceptible persons.

10. *Q. Does filling the primary teeth weaken the second teeth?*

A. No, careful operations on the primary teeth cause no reaction in the second teeth.

11. *Q. Should a primary tooth be removed when it appears that there will not be room enough for the second teeth to erupt?*

A. No, not as a rule. Because the primary teeth are usually smaller than the teeth that succeed them, their presence tends to stimulate the jaw to grow and thus make room for the second teeth. A dentist should be consulted.

12. *Q. Should a primary molar tooth that is lost several years too soon be replaced with a space maintainer?*

A. Sometimes the space caused by the premature loss of a baby molar does tend to close unless a space maintainer is used. Measurements should be taken by the dentist when the tooth is first lost, and regularly thereafter, to determine whether the space is becoming smaller. If it is evident that it is, a space maintainer should be inserted.

13. *Q. What causes black or green stain on children's teeth?*

A. Stains appear on the teeth of many children and young people. They occur in the mouths of healthy as well as unhealthy children. Their cause is not known, and they may reappear shortly after they have been removed.

14. *Q. What should one do if the central incisor tooth of a child 8 years old is broken accidentally?*

A. Since each fractured tooth is an individual problem, no definite plan of treatment can be advised. The child should be taken at once to a dentist, who will examine the tooth with the x-ray and probably place some medicated cement over the sensitive part of the fractured tooth. Frequently, if no protection is given to the tooth when it is broken, the pulp dies, and the tooth may then have to be removed. Sometimes it is only necessary for the dentist to smooth the rough edges of the break. If the fracture is a serious one,

it may be necessary, for protection of the pulp of the tooth from further injury, to cement over the broken edge of the tooth a band similar to the ones used when teeth are straightened.

15. *Q. What should be done about a wide space between the central incisor teeth of an 8 or 9 year old child?*

A. First of all, a dentist should be consulted. Usually, nothing need be done to bring these teeth together at this age, because the other permanent teeth, as they appear, usually push the central teeth together and thus provide self-correction.

16. *Q. Should something be done about the so-called "saw-edge" on the newly erupted incisor teeth?*

A. No. As a rule, when these teeth are in proper position, the pointed cusps begin to wear down as the child grows older, and the normal smooth "edge" is left.

17. *Q. Will such natural sweets as honey and maple syrup contribute to tooth decay as refined sugar and candies do?*

A. A research group at the School of Dentistry, University of Michigan, has demonstrated that there is little difference between natural sugars and refined sugars, as far as tooth decay is concerned.

18. *Q. Will brushing the teeth immediately after eating sweets prevent decay?*

A. No, although brushing the teeth is a commendable habit, even the most careful brushing cannot remove the sugar from the places where decay most frequently begins.

19. *Q. Is not some sugar necessary for the balanced diet?*

A. Specialists in nutrition tell us that the diet of the average American is overbalanced on the side of sweets. Consequently, the reduction of an excess of sugar such as is found in candy, jelly, frosting and syrups will help to make possible a better balanced diet.

20. *Q. Does a first permanent (six-year) molar tooth often have a cavity in it only a few months after it appears in the mouth?*

A. This tooth, like all teeth, grows from several different lobes or points, and these lobes unite to form the complete crown of the tooth. In the molar and bicuspid teeth, fissures normally remain after the tooth is fully developed. These fissures are caries-susceptible.

21. *Q. Should x-ray pictures be taken of children's teeth?*

A. Yes, as often as, or even more often than, adults' teeth in order to discover disease conditions and to follow up the development of the tooth germ. Also, x-ray pictures of a child's mouth will show whether the permanent teeth are present and in proper position, and whether there are beginning cavities between the teeth. X-ray pictures will also disclose any supernumerary teeth that may be present.

22. *Q. Is thumb-sucking harmful?*

A. Most authorities, both dentists and child psychologists, agree that such undesirable habits as this one should be discouraged as soon as possible.

23. *Q. When should a child first be taken to the dentist?*

A. The child should pay his first visit to the dentist when all twenty primary teeth are present in the mouth, usually between 2 and 3 years of age. Even though no cavities may be present at this time, it is wise to initiate a child into the routine of regular prophylaxis and examination in order to prevent later trouble.

24. *Q. If the primary teeth are poor, will the second ones also be bad?*

A. Not necessarily. The second teeth are formed after the baby is born. If the child has an adequate diet after birth, these teeth should at least be well formed.

25. *Q. What is a gum boil, and why does it occur?*

A. With the death of a pulp, which is

found inside each tooth, from injury or tooth decay, decomposition sets in because bacteria are attracted to the dead tissue. Gas forms and forces its way through the end of the root, and the bone around the end of the root becomes infected. An abscess forms and, as pus collects, it works its way through the bone and distends the gum similarly to a boil.

26. *Q. At what age should a child start using a toothbrush? Should the parent help the child brush his teeth?*

A. A child should start as soon as all the primary teeth have erupted, which is about 2 or 2½ years of age, and the parent will have to do most of the brushing for some time. It is a good idea to let the child brush his own teeth, the parent going over them after him. Thus, the child is forming a habit of regular toothbrushing while the parent is actually keeping the mouth clean.

27. *Q. How often should a child be brought to the dentist?*

A. It is impossible to set down a definite rule as to the times at which a child should visit the dentist since children, like adults, vary in mouth cleanliness and susceptibility to tooth decay. Each child must be judged individually. In general, it is desirable that the dental visits be made at least every six months. At grammar school age, and particularly teen age, the dental visits should be made at four-months intervals.

28. *Q. What is the proper age at which to begin straightening the teeth?*

A. It is advisable to consult an orthodontist as soon as any irregularities are noticed, because many conditions must be taken into consideration before such treatment is begun. Some cases need treatment when the child is only 3 years of age.

29. *Q. If a child's teeth seem to be slow in erupting, what should be done? Should the gums be lanced?*

A. Slow eruption may be familial, constitutional or a symptom of a systemic condition. The cause should be discovered before treatment is attempted. The lancing of the gums is usually not indicated. Frequently, gums that have

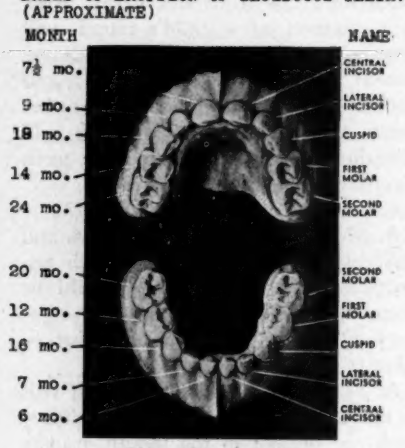


Chart of twenty deciduous (first) teeth

Figure 1.

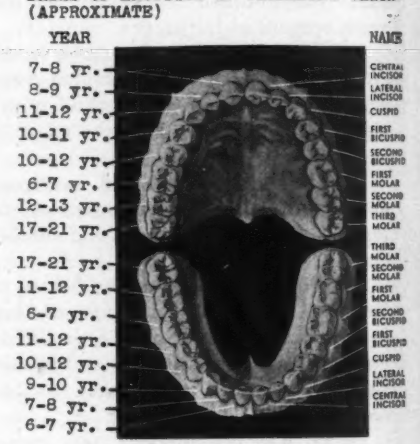


Chart of thirty-two permanent (second) teeth

Figure 2.

been lanced heal before the tooth comes through, and then it may be doubly hard for the tooth to erupt because the scar tissue is usually tougher than ordinary tissue. Such cases should be kept under observation by the dentist.

30. *Q. When do the primary teeth come into the mouth?*

A. See Figure 1.

31. *Q. When do the permanent teeth come into the mouth?*

A. See Figure 2.

Your Dental I. Q. Newspaper Articles

THE success of last year's "Your Dental I. Q." newspaper articles has prompted the Bureau of Public Relations to prepare a second series.

"Your Dental I. Q." consists of twenty-four illustrated newspaper articles on dental health in question and answer form. These articles have been prepared for publication in the local newspapers because the newspaper is the most nearly universally available printed medium for health education. Health columns are now a feature of practically all newspapers. By using "Your Dental I. Q.," dental societies can make dental health columns an equally popular feature.

The twenty-four articles in "Your Dental I. Q." can be obtained in mat form for $5.00, or in plate form for $7.50. Dental societies are requested to purchase one or more sets and have them published in one or more local newspapers. Last year, 135 newspapers with a total circulation of 1,328,337 published the first series of twenty-four articles. With that precedent, this year's use should be even wider.

Public relations chairmen of local dental societies are invited to use this material in their local papers. Direct your

inquiries to the Bureau of Public Relations, American Dental Association, 222 East Superior St., Chicago, Ill.

COUNCIL ON DENTAL HEALTH

VICTORY CORPS AND PHYSICAL FITNESS DENTAL PROGRAM

MISSISSIPPI

Gladys Eyrich, the director of the dental program in the state of Mississippi, in evaluating the Victory Dental Program conducted in the high schools of the state last year, reports that 100 per cent corrections were attained in the senior classes of several high schools and that many other schools reported highly encouraging results.

IOWA

Olin E. Hoffman, who is acting director of the Bureau of Dental Hygiene, reports that High School Victory Dental Program forms were distributed to 32,000 twelfth grade students in the later part of the last school year. From cards returned in the over-all program, it was indicated that corrections ranged from 11 to 100 per cent, with a general average of 34.6 per cent.

INDIANA

The Indiana State Dental Association devoted the entire August issue of the *Indiana State Dental Journal* to activities that are designed to launch and execute the High School Physical Fitness Health Program at the beginning of the present school year.

ALABAMA

The chairman of the Council on Dental Health of the Alabama Dental Association, with the endorsement of the state health officer and state superintendent of education, will request the Governor of Alabama to issue a proclamation designating the week of November 8, 1943, through November 12, 1943, as Dental Health Week in Alabama. The object of the Dental Health Week is to promote dental health throughout the state and especially to participate in the High School Victory Corps Physical Fitness Program. A week's concentrated effort in dental health will help to equip our boys and girls for the armed forces and industrial work. Emphasis and assistance given this group of young people will undoubtedly help in winning the war and preparing for the peace afterwards.

COUNCIL ON DENTAL THERAPEUTICS

DENTIFRICES

The Council has authorized publication of the following report.

DONALD A. WALLACE, *Secretary*

MANY inquiries in regard to the current status of various dentifrices are received daily by the office of the Council on Dental Therapeutics. It is assumed that practicing dentists are also asked many questions about dentifrices and it is therefore desirable to provide the members of the profession with a concise summary of the dentifrice situation as it exists today.

The bulk of this article will consist of brief statements, together with bibliographic references for nineteen of the most popular brands. In most instances, statements of composition are not given in detail since the formulas of many dentifrices have been changed during the past year owing to restrictions on the use of materials.

Tooth powders usually consist essentially of abrasives, such as calcium carbonate, calcium phosphate or calcium sulfate, and detergents, such as soap or sodium alkyl sulfate, together with saccharin or sugar and flavoring materials. Tooth pastes are similar in composition to tooth powders, except for the addition of water and binding and stabilizing agents such as glycerin, propylene glycol and vegetable gums. Dentifrices have no demonstrated therapeutic value, serving only to aid the brush in cleaning the accessible surfaces of the tooth.

Information which is included in regard to composition is based upon data that are believed to be reliable. In many instances, the information has been supplied by the vendors of the dentifrices. In some instances, analyses have been made by the A.D.A. Bureau of Chemistry. In view of the tendency of unaccepted dentifrices to change in composition without warning, formulas for such products should be considered as tentative.

ARM & HAMMER AND COW BRAND BAKING SODA

Arm & Hammer and Cow Brand Baking Soda are stated to comply with the U.S.P. requirements for sodium bicarbonate. They have been accepted by the Council for use as dentifrices since 1938.

CALOX TOOTH POWDER

Calox Tooth Powder consists of materials commonly used in dentifrices, with added sodium perborate and calcium peroxide, neither of which has been shown to be harmless or desirable in a dentifrice designed for unsupervised daily use by the public.

The advertising for this product has included many misleading slogans and statements.

Calox Tooth Powder is not acceptable to the Council. (J.A.D.A., 22:140, January 1935; 27:448, March 1940.)

COLGATE'S DENTIFRICES

Colgate's Dentifrices include Colgate's Dental Cream, Colgate Tooth Powder and Cue, a liquid dentifrice.

Colgate Dental Cream was accepted by the Council in 1930, but was deleted in 1934 as a result of the firm's violation of the Council's rules governing advertising of accepted products.

In 1940, the firm stipulated with the Federal Trade Commission that it would cease advertising unqualifiedly that "most bad breath begins with the teeth" or that "a safe, sure way to correct bad breath is through regular use of the

thorough, cleansing action provided only by the special ingredients in Colgate's Dental Cream."

The advertising themes of the firm since then include the "weasel word" "oral" modifying "bad breath." Thus, instead of saying "most bad breath begins with the teeth," the firm says "in 7 out of 10 cases, Colgate Dental Cream instantly stops oral bad breath." The word "oral" is indefinite and the lay person is, of course, unable to tell whether his bad breath is of "oral" origin. Confusion is thus created in the mind of the reader of the ad and he may turn to Colgate's Dental Cream in the hope that it might improve the odor of his breath.

Colgate's dentifrice advertising has frequently employed pictures of men dressed in the office attire of dentists in order to carry its fear theme home to the public. Such abuse of the prestige of the dental profession should be condemned.

The records of the Council office indicate that Colgate dentifrices are of conventional composition. The firm has supplied no evidence that would support the claim regarding their superiority in any respect. It has recently been asked for information concerning the composition of its dentifrices, but has not supplied such information.

Cue is not acceptable to the Council, since evidence that a liquid dentifrice is an adequate aid to the brush in cleaning the teeth has not been presented. (J.A.D.A., 25:1854, November 1938; 27:1310, August 1940; 29:135, January 1942.)

CRAIG-MARTIN DENTIFRICES

The Craig Martin Dentifrices are Craig-Martin Tooth Paste, Craig-Martin Tooth Powder (Foamy Type), Craig-Martin Tooth Powder for Ration Kits and Craig-Martin Liquid Dentifrice. The paste and powders are accepted by the Council. The powder for ration kits is a salt and soda preparation designed for use by members of the armed forces.

Craig-Martin dentifrices are available in many of the 10-cent stores.

Craig-Martin Liquid Dentifrice is not acceptable to the Council, since evidence that a liquid dentifrice is an adequate aid to the brush in cleaning the teeth has not been presented.

FORHAN'S TOOTH PASTE

Forhan's Tooth Paste, which is not acceptable to the Council, has been advertised for years as useful in the treatment of pyorrhea or gingivitis. The notorious "four out of five" theme has been frequently employed in the advertising of this product. A careful analysis conducted by the A.D.A. Bureau of Chemistry in 1942 failed to reveal the presence of any ingredient that might be therapeutically significant. In fact, Forhan's Tooth Paste was found to be an ordinary soap-chalk-glycerin mixture with coloring and flavors added. (J.A.D.A., 30:129, January 1, 1943. F.T.C. Complaint 5031, August 23, 1943.)

IODENT TOOTH PASTES NO. 1 AND NO. 2 IODENT TOOTH POWDER

The Iodent Tooth Pastes and Iodent Tooth Powder are dentifrices of conventional composition.

Iodent Tooth Paste No. 1 and Iodent Tooth Paste No. 2 were accepted in 1931. They were deleted in 1939 for failure to comply with Council requirements in regard to labels and advertising. (J.A.D.A., 26:1194, July 1939.)

IPANA TOOTH PASTE

Ipana Tooth Paste is not acceptable to the Council. The Council recently published a report in which the merchandising policies of Bristol-Myers Company with respect to this product were critically discussed. Ipana has been the subject of numerous unfavorable reports issued by the Council and by the

Federal Trade Commission and the Food and Drug Administration.

The favorite Ipana advertising theme runs somewhat as follows: "If your toothbrush 'shows pink'—see your dentist promptly. His verdict may be 'lazy gums'—gums that need more exercise. He probably will blame modern soft foods—foods that require little chewing. And he may suggest, as so many dentists do, 'the healthful stimulation of Ipana and massage.' "

While this type of advertising, together with profligate distribution of free samples of Ipana to the dentists, and other "professional service" activities, has apparently increased the sale of Ipana, it has not, so far as the Council is aware, brought about any improvement in the dental health of the users of Ipana.

Picture the reaction of Mr. Average American upon reading the above-quoted advertising. He doesn't want to go to see his dentist, for that means expense, possible physical discomfort and time consumed. However, the firm does not let him down. It goes on to diagnose his difficulty and prescribe the treatment. Very likely, Mr. Average American will go out and buy some Ipana Tooth Paste and put off seeing his dentist.

Suppose Mr. Average American is afflicted with traumatic occlusion, subgingival calculus or some pathologic gingival condition. How much good is it going to do him to rub and brush his gums, with or without Ipana? He will be fortunate if he receives professional care in time to prevent severe damage.

The Council considers this type of advertising especially objectionable in that it tends to cause many readers to delay proper treatment for a condition which may become chronic and perhaps very serious unless it receives prompt care by a dentist.

Information in the Council's files, accumulated over a period of many years, does not reveal that Ipana has ever possessed significant therapeutic properties. It is a rather complex soap-chalk mixture, colored and highly flavored. (J.A.D.A., 22:2223, December 1934; 24:1557, September 1937; 29:2244, December 1, 1942. Notice of Judgment (Cosmetic) 92, February 1943. F.T.C. Complaint, J.A.D.A., 30:1109, July 1, 1943.)

KOLYNOS DENTIFRICES

Kolynos Dental Cream is accepted by the Council, whereas Kolynos Tooth Powder is not. The powder is stated to contain a foam-producing detergent of rather complex formula. The manufacturer of the detergent has not yet supplied sufficient scientific evidence to demonstrate beyond reasonable doubt that the foam-producer is safe for use in a dentifrice.

Kolynos Dental Cream has had a long and varied history. However, the firm has marketed this product in conformity with the Council's rules since it was accepted in December 1939. The Council believes that credit is due to any firm which markets a dentifrice on an ethical basis in competition with the aggressively misleading marketing policies of many competing brands.

LACTONA DENTIFRICE

Lactona Dentifrice, a tooth paste, has been accepted by the Council since 1933.

LISTERINE DENTIFRICES

Listerine Tooth Paste and Listerine Tooth Powder are not acceptable to the Council. The advertising for these products has included claims that their use will prevent, or lower the incidence of, tooth decay. The claims have been based on the presence of "Luster-Foam," a soap substitute used in the product.

There is no currently available scientific evidence that any inhibition or prevention of caries that may follow regular daily brushing of the teeth is due to the use of any foam-producing agent which may be contained in the dentifrice

used. (J.A.D.A., 26:1709, October 1939.)

DR. LYON'S TOOTH POWDER

Dr. Lyon's Tooth Powder is of simple conventional composition. Experiments conducted in the A.D.A. Bureau of Chemistry indicate that it is relatively abrasive when tested in the laboratory.

The Federal Trade Commission recently issued a cease and desist order requiring the vendors, the R. L. Watkins Co., to stop "disseminating advertisements containing the statement 'Do As Your Dentist Does . . . Use Powder,' or any other statement of like import. . . ."

The Commission found that the product was ". . . wholly without therapeutic properties. . . ."

The use of the prefix "Dr." in the title of the product may tend to create in the mind of the public the impression that the product is superior to other dentifrices which do not bear such a distinguishing mark. This practice is misleading and is discouraged by the Council. Dr. Lyon's Tooth Powder is not acceptable to the Council. (J.A.D.A., 29:2246, December 1, 1942; 27:1133, July 1940.)

PEBECO DENTIFRICES

Pebeco dentifrices are not accepted by the Council. Pebeco Tooth Paste was accepted in 1931 on the condition that advertising for the product would be revised and that the firm would undertake experiments looking toward the omission of potassium chlorate, or to reducing it in content. The product was deleted in 1933 when the firm reverted to an objectionable type of advertising.

Information received from the firm in 1942 indicates that its dentifrices are of conventional composition except for the presence of 10 per cent of potassium chlorate in the paste. In the opinion of the Council, potassium chlorate is not a desirable or necessary dentifrice ingredient. (J.A.D.A., 20:2248, December 1933.)

PEPSODENT DENTIFRICES

Pepsodent Tooth Paste, Pepsodent Tooth Powder and Pepsodent Liquid Dentifrice were accepted by the Council in 1939, but were deleted in 1941 as a result of violations of the Council's liberal rules in regard to advertising.

Exaggerated and misleading claims for Pepsodent Tooth Paste and Pepsodent Tooth Powder have characterized the firm's advertising for many years. The firm has attempted to endow the word "Irium" which is applied to the soap substitute used in its products, with extraordinary virtues which it does not possess. Claims for polishing power and ability to remove "film" are also misleading and are based on inadequate evidence. (J.A.D.A., 28:639, April 1941.)

PYCOPÉ TOOTH POWDER

Pycopé is a tooth powder of the flavored salt-and-soda type. It has been accepted by the Council since 1933.

REVELATION TOOTH POWDER

Revelation Tooth Powder is not accepted by the Council. It is a dentifrice of conventional formula.

The advertising and label claims for this product have been brought more nearly into line with scientific evidence during recent years.

SQUIBB DENTAL CREAM

Squibb Dental Cream was accepted by the Council in 1931 and deleted in 1933 as a result of violation of the Council's rules with regard to advertising.

It is to be regretted that a firm which manufactures so many meritorious products should continue over the years to disseminate misleading information in regard to its dentifrice products. Claims for acid-neutralizing properties of Squibb Dentifrice are not substantiated by clinical evidence. The scare advertising in

which the firm has indulged is definitely objectionable.

The firm was asked to supply information concerning the composition of its dentifrices for the information of the profession in 1942, but declined to do so. There is no evidence that Squibb dentifrices have any therapeutic value whatever. (J.A.D.A., 20:2248, December 1933; 29:869, May 1, 1942.)

TEEL

Teel Liquid Dentifrice is not accepted by the Council. There is available evidence that it is inferior as a cleaning agent to many of the popular brands of pastes and powders, and its use permits discoloration, which can be removed from the teeth only by a substance having abrasive properties.

Current lay advertising for Teel advises the weekly use of baking soda in addition to Teel without explaining why. Baking soda is an excellent dentifrice and its use would naturally aid in the removal of superficial stains that might have accumulated during the time when only Teel was used.

It has not, therefore, been demonstrated that Teel adequately performs the sole function of a dentifrice; namely, to aid the brush in cleaning the accessible surfaces of the teeth. (J.A.D.A., 28:1682, October, 1941; 30:1109, July 1, 1943.)

VRAY

Vray, which is advertised as "not a liquid, not a paste," is a fluid suspension of dentifrice abrasives in a liquid vehicle.

Examination of the product in the A.D.A. Bureau of Chemistry in 1941 revealed that it consisted essentially of calcium sulfate, calcium phosphate, glycerin, starch, flavors, coloring, a detergent and water. Information recently supplied by the firm states that the product contains two detergents, the sodium salt of lauryl sulfoacetate and a detergent derived from egg albumin.

The labeling and advertising for the product have not always conformed to Council standards. It is not accepted.

CONCLUSION

The listing as given above is by no means complete. There are eighty-three dentifrices listed in A.D.R. and nearly a thousand on the market in the United States.

An up-to-date statement of composition for any dentifrice that is accepted by the Council on Dental Therapeutics can be obtained by addressing a postal card to the Secretary of the Council on Dental Therapeutics, 222 East Superior St., Chicago, Ill. Such statements of composition are also published, with much other concise information, in the Council's book, Accepted Dental Remedies, which is revised annually and may be purchased from the American Dental Association for one dollar.

The Council's activities during the fifteen years of its existence have resulted in improvement of most dentifrices from the standpoint of quality and, in many cases, in advertising as well. The members of the profession can help to further the Council's dentifrice program by advising all of their patients to use only accepted dentifrices. A list of such dentifrices is sent free to any one who requests it from the Secretary of the Council. Accepted dentifrices are obtainable at almost all drug, 10-cent and variety stores throughout the country.

DIRECTORY OF STATE SOCIETY OFFICERS AND DATES OF MEETINGS, 1943-1944

ALABAMA DENTAL ASSOCIATION

Herbert H. Bryans, President.....Comer Bldg., Birmingham
Pryor A. Williams, Secretary-Treasurer....1005 Protective Life Bldg., Birmingham
Next annual meeting:

ARIZONA STATE DENTAL SOCIETY

Taylor T. Hicks, President.....12-14 Bashford Bldg., Prescott
Melvin Saxman, President-Elect.....910 Professional Bldg., Phoenix
R. D. McDonald, Secretary-Treasurer.....601 Valley Bank Bldg., Tucson
Next annual meeting: Tucson, April 21-22, 1944.

ARKANSAS STATE DENTAL ASSOCIATION

A. C. Brasel, President.....Dermott
W. R. Hunt, Jr., President-Elect...Clarksville
I. M. Sternberg, Secretary-Treasurer.....Merchants Bank Bldg., Fort Smith
Next annual meeting: Little Rock.

SOUTHERN CALIFORNIA STATE DENTAL ASSOCIATION

Francis J. Conley, President.....1052 West 6th St., Los Angeles, 14
Albert C. Vieille, President-Elect.....727 West 7th St., Los Angeles, 14
Robert L. Borland, Secretary.....603 Chapman Bldg., Los Angeles, 14
Harry H. Bleecker, Treasurer.....5410 Wilshire Blvd., Los Angeles, 5
Next annual meeting:

CALIFORNIA STATE DENTAL ASSOCIATION

George W. Hahn, President.....2300 Durant Ave., Berkeley, 4
Ernest F. Soderstrom, President-Elect.....Beaty Bldg., Modesto
Lloyd E. Linehan, Secretary.....135 Stockton St., San Francisco, 8
John W. Hagan, Treasurer.....1505 Webster St., Alameda
Next annual meeting:

COLORADO STATE DENTAL ASSOCIATION

W. W. Cogswell, Sr., President.....16 Berthe Circle, Colorado Springs
A. B. Thurston, President-Elect.....Grand Junction
Albert P. Horton, Secretary.....Metropolitan Bldg., Denver
Charles H. Watson, Treasurer.....Metropolitan Bldg., Denver
Next annual meeting: Denver, June 15-16-17, 1944.

CONNECTICUT STATE DENTAL ASSOCIATION

Hugh Gibb, Jr., President.....107 Whitney Ave., New Haven, 10
John Murren, President-Elect.....616 Medical Bldg., Bridgeport, 3
Earle S. Arnold, Secretary-Treasurer.....37 Linnard Road, West Hartford, 7
Next annual meeting:

DELAWARE STATE DENTAL SOCIETY

John A. Casey, President.....Medical Arts Bldg., Wilmington
Paul K. Musselman, First Vice-President.....Newark
Morris Greenstein, Second Vice-President.....Medical Arts Bldg., Wilmington
Charles F. Pierce, Secretary.....611 Delaware Ave., Wilmington
Henry S. Keavenay, Treasurer.....922 Jefferson St., Wilmington
Next annual meeting:

DISTRICT OF COLUMBIA DENTAL SOCIETY

W. T. Birthright, President.....1835 Eye St., N.W., Washington, D.C.
W. L. Smallwood, President-Elect.....910—17th St., N.W., Washington, D.C.
J. Walter Bernhard, Secretary-Treasurer....1835 Eye St., N.W., Washington, D.C.
Next annual meeting: Washington.

FLORIDA STATE DENTAL SOCIETY

A. Malcolm Smith, President.....609 Stovall Bldg., Tampa
E. C. Lunsford, President-Elect.....2742 Biscayne Blvd., Miami
Horace L. Cartee, Secretary-Treasurer.....910 Huntington Bldg., Miami
Next annual meeting: Jacksonville, November 10, 11, 1943.

GEORGIA STATE DENTAL ASSOCIATION

J. Stegall, President.....Lindale
William A. Garrett, President-Elect.....833 Candler Bldg., Atlanta

R. H. Murphy, Secretary.....605 Bankers Ins. Bldg., Macon
Frank Tillery, Treasurer.....Columbus
Next annual meeting: Atlanta, May 7-10, 1944.

HAWAII TERRITORIAL DENTAL SOCIETY

Roy Stisher, President.....P. O. Box 156, Kahului, Maui
H. L. Houvener, President-Elect.....Pantheon Bldg., Honolulu
John H. Dawe, Secretary.....P. O. Box 39, Honolulu
F. S. Kagihara, Treasurer.....1476 S. King St., Honolulu
Next annual meeting: Honolulu, October 28-30, 1943.

IDAHO STATE DENTAL ASSOCIATION

Vaughn Lyons, President.....Pocatello
W. F. Gigray, President-Elect.....Caldwell
Philip C. Call, Secretary.....Pocatello
L. E. Shaw, Treasurer.....Pocatello
Next annual meeting: June 1944.

ILLINOIS STATE DENTAL SOCIETY

Frank J. Hurlstone, President.....30 N. Michigan Ave., Chicago
N. A. Arganbright, President-Elect.....400 State Bank Bldg., Freeport
L. H. Jacob, Secretary.....634 Jefferson Bldg., Peoria
R. W. McNulty, Treasurer.....1757 W. Harrison St., Chicago
Next annual meeting: Springfield, May 8-11, 1944.

INDIANA STATE DENTAL ASSOCIATION

Roy D. Smiley, President..Peoples Bank & Trust Bldg., Washington
Lynn A. Fonner, President-Elect.....1100 E. Creighton Ave., Fort Wayne
E. E. Ewbank, Secretary.....Kingman
William Bogie, Treasurer.....American Natl. Bk. Bldg., Vincennes
Next annual meeting: Indianapolis, May 15-17, 1944.

IOWA STATE DENTAL SOCIETY

I. C. Hemsworth, President.....Black Bldg., Waterloo
J. J. Foley, President-Elect.....Physicians Bldg., Fort Dodge
C. S. Foster, Secretary.....Dows Bldg., Cedar Rapids
L. C. Dow, Treasurer.....Marion
Next annual meeting: Des Moines, May 1-2, 1944.

KANSAS STATE DENTAL ASSOCIATION

R. E. Olson, President.....Union Natl. Bank Bldg., Wichita
L. E. Alquist, President-Elect....Clay Center
Fred A. Richmond, Secretary.....1008 Huron Bldg., Kansas City
Stanley H. Flickinger, Treasurer.....Baldwin
Next annual meeting: Topeka.

KENTUCKY STATE DENTAL ASSOCIATION

Frank B. Hower, President.....814 Heyburn Bldg., Louisville
Russell I. Todd, President-Elect.....Western Union Bldg., Richmond
J. L. Walker, Secretary-Treasurer.....640 Barbee Way South, Louisville
Next annual meeting: Louisville.

LOUISIANA STATE DENTAL SOCIETY

Walter L. Comeaux, President.....La. Natl. Bank Bldg., Baton Rouge
J. Melville Smith, 3rd, President-Elect....Maison Blanche Bldg., New Orleans
Julian S. Bernhard, Secretary.....Medical Arts Bldg., Shreveport
Oscar J. Ory, Treasurer.....Garyville
Next annual meeting: Shreveport, April 13-15, 1944.

MAINE DENTAL SOCIETY

R. A. Derbyshire, President.....Skowhegan
Harvard E. Colwell, President-Elect..Lincoln
George S. Nevens. Box 63, Damariscotta Mills
Edward W. Peaslee, Treasurer.....Augusta
Next annual meeting: June 1944.

MARYLAND STATE DENTAL ASSOCIATION

Myron S. Aisenberg, President.....3619 Rosedale Road, Baltimore
J. W. McCarl, President-Elect.....Greenbelt
Paul A. Deems, Secretary.....835 Park Ave., Baltimore
William Daniel Day, Treasurer.....Medical Arts Bldg., Baltimore
Next annual meeting: Baltimore, May 1-2, 1944.

MASSACHUSETTS DENTAL SOCIETY

Harold J. Cronin, President.....739 Liberty St., Springfield
John R. Wallace, President-Elect.....No. 1 Mt. Vernon St., Winchester
Philip E. Adams, Secretary.....106 Marlborough St., Boston

Harold E. Tingley, Assistant Secretary.....12 Bay State Road, Boston
Glenn W. Lawrence, Treasurer.....412 Beacon St., Boston
Next annual meeting: Boston, May 15-17, 1944.

MICHIGAN STATE DENTAL SOCIETY

O. C. Applegate, President.....216 S. State St., Ann Arbor
M. S. deVilliers, President-Elect.....4400 Livernois Ave., Detroit
William R. Davis, Secretary.....Michigan Dept. of Health, Lansing
H. C. Gerber, Executive Secretary.....1514 Olds Tower Bldg., Lansing
F. J. Henry, Treasurer.....1170 Madison Ave., S.E., Grand Rapids
Next annual meeting: Detroit, April 17-19, 1944.

MINNESOTA STATE DENTAL ASSOCIATION

W. Lester Webb, President.....Fairmount
L. W. Thom, President-Elect.....Medical Arts Bldg., Minneapolis
L. M. Cruttenden, Secretary.....498 Lowry Bldg., St. Paul
A. R. Schmid, Treasurer.....Worthington
Next annual meeting: St. Paul, March 1-3, 1944.

MISSISSIPPI DENTAL ASSOCIATION

T. Ford Leggett, President.....Laurel
W. T. Townsend, President-Elect...Cleveland
O. L. Colee, Secretary-Treasurer...Magnolia
Next annual meeting:

MISSOURI DENTAL STATE ASSOCIATION

D. H. Phelps, President.....Box 243, Nevada
Otto W. Brandhorst, President-Elect.....4952 Maryland Ave., St. Louis
C. W. Digges, Secretary-Treasurer.....Exchange Natl. Bank Bldg., Columbia
Next annual meeting: Jefferson City.

MONTANA STATE DENTAL ASSOCIATION

Joseph A. Herzog, President.....Butte
F. G. Dratz, President-Elect.....Missoula
T. T. Rider, Secretary-Treasurer.....9 Higgins Block, Missoula
Next annual meeting: Billings, May 4-6, 1944.

NEBRASKA STATE DENTAL ASSOCIATION

J. G. Colgan, President.....McCook
B. Dienstbier, President-Elect.....City Natl. Bank Bldg., Omaha
F. A. Pierson, Secretary.....Federal Securities Bldg., Lincoln
C. C. Lillibridge, Treasurer.....Crete
Next annual meeting: Lincoln, May 8-10, 1944.

NEVADA STATE DENTAL ASSOCIATION

Stephen Comish, President.....Henderson Bank Bldg., Elko
Louis M. Nelson, Secretary-Treasurer.....Box 2039, Reno
Next annual meeting:

NEW HAMPSHIRE DENTAL SOCIETY

E. C. Godfrey, President.....90 Washington St., Dover
H. E. Copeland, President-Elect....Rochester
F. E. Williams, Secretary.....814 Elm St., Manchester
William A. Young, Treasurer.....40 N. Main St., Concord
Next annual meeting: June 1944.

NEW JERSEY STATE DENTAL SOCIETY

S. F. Reese, President.....Weymouth & Atlantic Aves., Ventnor
Eugene W. Newman, President-Elect.....16 Wallace St., Red Bank
James H. Samuel, Vice-President.....Record Bldg., Morristown
F. K. Heazelton, Secretary.....223 E. Hanover St., Trenton
Charles P. Crowe, Treasurer.....521 Main St., East Orange
Next annual meeting:

NEW MEXICO STATE DENTAL SOCIETY

D. R. Biddle, President .....Albuquerque
J. A. Eilar, Secretary-Treasurer.....First Natl. Bank Bldg., Albuquerque
Next annual meeting:

DENTAL SOCIETY OF THE STATE OF NEW YORK

Leon L. Abbey, President.....619 Union St., Schenectady
Joseph M. Glaser, President-Elect.....137-01 Jamaica Ave., Jamaica

Charles A. Wilkie, Secretary.....No. 1 Hanson Place, Brooklyn
George D. Greenwood, Treasurer.....Mercantile Bldg., Rochester
Next annual meeting: Buffalo, May 9-12, 1944.

NORTH CAROLINA DENTAL SOCIETY

C. E. Minges, President.....Peoples Bank Bldg., Rocky Mount
C. C. Barker, President-Elect.....Asheville
E. M. Medlin, Secretary-Treasurer..Aberdeen
Next annual meeting: Raleigh, May 1-3, 1944.

NORTH DAKOTA STATE DENTAL ASSOCIATION

W. J. Smith, President.....Jamestown
E. J. Hughes, President-Elect.....Langdon
F. A. Maides, Secretary.....Grand Forks
J. A. Chestnut, Treasurer.....Leeds
Next annual meeting: Grand Forks, May 1944.

OHIO STATE DENTAL SOCIETY

T. J. McDermott, President.....821 Rose Bldg., Cleveland
C. H. Hebble, President-Elect.....327 E. State St., Columbus
Edward C. Mills, Secretary.....255 E. Broad St., Columbus
Earl G. Jones, Treasurer.....185 E. State St., Columbus
Next annual meeting: Cleveland, November 7-10, 1943.

OKLAHOMA STATE DENTAL SOCIETY

G. A. Roelke, President.....Medical Arts Bldg., Tulsa
Chas. A. Hess, President-Elect.....Durant
I. E. Cordrey, Vice-President.....Blackwell
Eugene W. Wise, Secretary.....Medical Arts Bldg., Tulsa
W. C. Travis, Treasurer.....Chickasha
Next annual meeting:

OREGON STATE DENTAL ASSOCIATION

John C. Bartels, President.....Selling Bldg., Portland
John Kurati, Jr., President-Elect.....Medical Arts Bldg., Portland
A. P. Watson, Vice-President.....2939 N. Willamette Blvd., Portland
F. W. Hollister, Secretary-Treasurer.....Selling Bldg., Portland
Next annual meeting:

PANAMA CANAL ZONE DENTAL SOCIETY

George R. Tressel (Col.), President.....APO 825, P. O., New Orleans, La.
Robert W. Chapin (Capt.), President-Elect....Colon Hospital, Cristobal, Canal Zone
Bernard C. Hammon (Maj.), Secretary-Treasurer.....APO 825, P. O., New Orleans, La.
Next annual meeting:

PENNSYLVANIA STATE DENTAL SOCIETY

LeRoy M. Ennis, President.....4001 Spruce St., Philadelphia
H. K. Cooper, President-Elect.....26 N. Lime St., Lancaster
Edward R. Aston, Secretary.....421 Market St., Kingston
C. J. Hollister, Executive Secretary.....217 State St., Harrisburg
Wayne D. Kelly, Treasurer.....Payne-Shoemaker Bldg., Harrisburg
Next annual meeting: Scranton, May 2-4, 1944.

PHILIPPINE ISLANDS DENTAL SOCIETY

Joaquin Ladao, President.....208 Kneedler Bldg., Manila
Gil Mantinela, Vice-President.....Manila
Faustino F. Turla, Secretary-Treasurer....777 Legarda St., Manila
Next annual meeting:

COLEGIO DE CIRUJANOS DENTISTAS DE PUERTO RICO

Jose Vincente, President.....Apartado 1448, San Juan
Luis Munoz Santaella, Vice-President.....Rio Piedras
Juan Font Suarez, Secretary.....Apartado 1448, San Juan
J. Hermandez Gonzales, Treasurer.....Apartado 1448, San Juan
Next annual meeting:

RHODE ISLAND STATE DENTAL SOCIETY

Maurice A. Denby, President.....7 Washington St., Warren
Earl B. Keighley, Vice-President.....12 Summer St., Pawtucket
Arthur M. Dring, President-Elect.....166 Thames St., Newport

Charles F. McKivergan, Secretary.....102 Waterman St., Providence
William S. Gee, Jr., Treasurer.....745 Main St., West Warrick
Next annual meeting: Providence, January 1944.

SOUTH CAROLINA STATE DENTAL ASSOCIATION

L. E. Dellinger, President.....Greenville
C. M. Douglas, President-Elect.....State Hospital, Columbia
P. B. Hair, Secretary-Treasurer..Spartanburg
Next annual meeting: Columbia, May 1944.

SOUTH DAKOTA STATE DENTAL SOCIETY

A. A. Wollman, President.....Huron
E. Hohf, President-Elect.....Mitchell
Ernest W. Elmen, Secretary.....Sioux Falls
W. H. Morgans, Treasurer.....Aberdeen
Next annual meeting: Mitchell, May 7-9, 1944.

TENNESSEE STATE DENTAL ASSOCIATION

Roy O. Elam, President.....Medical Arts Bldg., Nashville
C. N. Williams, President-Elect.....Exchange Bldg., Memphis
E. J. Justis, Secretary-Treasurer.....Exchange Bldg., Memphis
Next annual meeting: Nashville, November 21-24, 1943.

TEXAS STATE DENTAL SOCIETY

Stuart E. Hays, President.....Medical Arts Bldg., San Antonio
J. T. Edwards, President-Elect.....Medical Arts Bldg., Fort Worth
Willard Ogle, Secretary-Treasurer.....Medical Arts Bldg., Dallas
Next annual meeting: Houston, April 17-20, 1944.

UTAH STATE DENTAL ASSOCIATION

D. A. Jones, President.....First Natl. Bank Bldg., Salt Lake City
C. G. Green, President-Elect.....Boston Bldg., Salt Lake City
Carl M. Decker, Secretary-Treasurer.....Felt Bldg., Salt Lake City
Next annual meeting: Salt Lake City, June 7-9, 1944.

VERMONT STATE DENTAL SOCIETY

Norman F. Johnson, President.....Rutland
Byron W. Bailey, First Vice-President.....Bradford
J. Gillam Irons, Secretary.....Bennington
Howard F. Killary, Treasurer.....Burlington
Next annual meeting:

VIRGINIA STATE DENTAL ASSOCIATION

Paul Burbank, President.....Hampton
W. S. Gilmer, President-Elect.....Pulaski
J. E. John, Secretary-Treasurer.....804 Medical Arts Bldg., Roanoke
Next annual meeting: Richmond, April 3-5, 1944.

WASHINGTON STATE DENTAL ASSOCIATION

L. L. Foote, President.....1233 Medical & Dental Bldg., Seattle
G. D. Williams, President-Elect.....511 Paulsen Bldg., Spokane
A. W. Jeffery, Secretary-Treasurer.....533 Medical & Dental Bldg., Seattle
Next annual meeting:

WEST VIRGINIA STATE DENTAL SOCIETY

C. M. Musser, President.....Fairmont
W. Ross Batson, President-Elect..Pine Grove
M. H. Nicholson, Secretary.....Bluefield
John S. Stone, Treasurer.....Clarksburg
Next annual meeting: Huntington, May 15-17, 1944.

WISCONSIN STATE DENTAL SOCIETY

J. P. Justin, President.....2225 W. Capitol Drive, Milwaukee
J. F. Baumgartner, President-Elect.....West Bend
Kenneth F. Crane, Executive Secretary.....1233 Bankers Bldg., Milwaukee
R. A. Mason, Secretary.....964 N. 27th St., Milwaukee
C. P. Collins, Treasurer.625 57th St., Kenosha
Next annual meeting: Milwaukee, March 20-22, 1944.

WYOMING STATE DENTAL ASSOCIATION

J. E. Beal, President.....Casper
H. A. O'Malley, President-Elect.Rock Springs
J. D. McNiff, Secretary-Treasurer...Laramie
Next annual meeting: June 1944.

COMMITTEE ON ECONOMICS

ECONOMIC STATUS OF THE DENTAL PROFESSION—1941

R. M. WALLS,* D.D.S., and M. L. DOLLAR†

ONE of the primary duties of the Committee on Economics of the American Dental Association is to keep in close touch with economic conditions among the members of the dental profession. To perform this duty, the Committee finds it necessary, from time to time, to take the economic pulse of the profession. Since the individual dentist is the only source of reliable information regarding his own income, the necessary information can best be obtained through a survey in which the members of the profession are asked to participate.

Several months ago, a nation-wide survey was undertaken to bring up to date the information on incomes of dentists. Because this information is of interest to both the American Dental Association and the United States Department of Commerce, the Committee had the good fortune to obtain the assistance of the Income Section of that agency. Undertaking the study as a joint endeavor offered advantages to both of the cooperating agencies, since the costs were shared and the technical and clerical staffs of both organizations had a part in planning and carrying out the project.

The Committee takes this opportunity to thank the many thousands of dentists, both members and non-members of the American Dental Association, who participated in the project. Without their aid, the study could not have been made. The Committee also wants especially to express their appreciation to Mr. Milton Gilbert and to Mr. Edward F. Denison and their staff of the National Income Unit for their cooperation.

*Chairman, Committee on Economics.
†Secretary, Committee on Economics.

METHOD OF STUDY AND REPRESENTATIVENESS OF THE SAMPLE OF DENTISTS PARTICIPATING IN THE SURVEY

With the aid of the United States Department of Commerce, a questionnaire was prepared and mailed to every dentist in the United States, both to members and to non-members of the American Dental Association. In all, 13,489 questionnaires were returned which were filled out in detail complete enough to make it possible to utilize them in the survey. This represents approximately 17 per cent of all of the dentists in the United States. Thus, in terms of numbers, the sample is adequate to give a fair representation.

While it is not possible in a survey of this type to check all of the sources of bias, we are fortunate, in this instance, to be able to measure the representativeness of the group who participated in the survey with respect to some of the more important factors. For instance, in comparing the distribution of the dentists who participated in the survey with reference to the geographic area in which they reside with the distribution of the total dental population (Table 1), it is found that the sample corresponds almost exactly. In no area does the difference amount to more than 2 per cent.

A comparison of the distribution of the dentists included in the sample with respect to size of the community in which they are practicing with the distribution of the total dental population again shows that the sample affords an almost perfect representation. This is clearly demonstrated by the comparative distribution shown in Table 2 and by the graphic comparison shown in Figure 1.

A third important factor in the representativeness of the sample which it has been possible to check is that of distribution according to age of the dentists participating in the survey. Comparison (Table 3) shows the age distribution of the sample to almost exactly duplicate that of the total dental population. This is forcefully demonstrated by the fact that, in Figure 2, which shows a cumulative percentage of dentists according to age, the distribution for the total dental agreement with the percentage of all dentists who hold membership in the Association. Sixty-eight per cent of the returns came from members and 32 per cent from non-members, as compared with 65 per cent of all dentists who are members and the 35 per cent of all dentists who are non-members of the American Dental Association. While a small difference exists, correction has been made in all tables to account for this discrepancy.

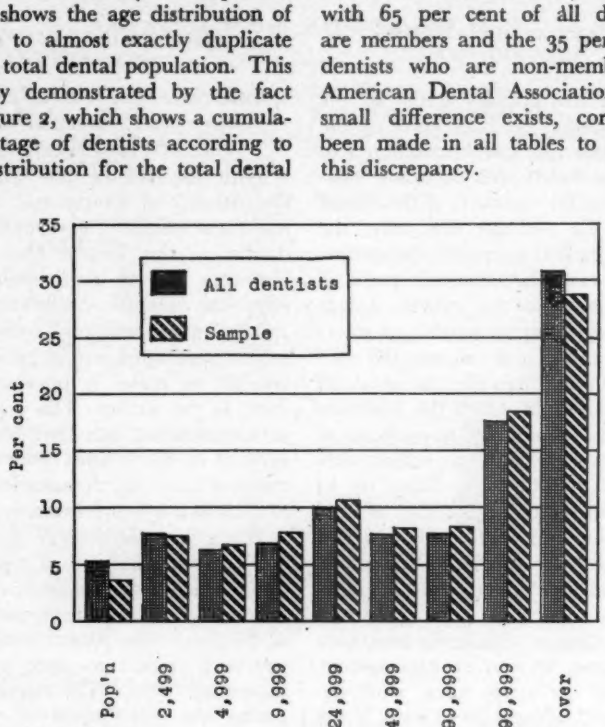


Fig. 1.—Comparison of distribution of dentists included in income study sample with distribution of all dentists according to size of community (1941).

population and that for the sample are so similar as to make it impossible to distinguish between them in drawing the graph.

Of all the schedules returned, the percentage received from members of the American Dental Association is in close

There are, of course, some sources of bias which it is impossible to check. For instance, it is commonly thought that there is a greater reluctance on the part of men in the upper income brackets to respond to a questionnaire of this type than is the case among men in the lower

income brackets. However, there does not seem to be any evidence that this is true in the present sample.

AVERAGE NET INCOME OF DENTISTS

Size of Community and Age (Tables 4 and 5; Figs. 3-6).—The average net income of dentists in the United States for the year 1941 was $3,773. The average income of members of the American Dental Association is found to be considerably higher than the income of non-members, the average for members being $4,177, and for non-members, $2,941.

It is found also that there exists a positive correlation between the size of the community in which the dentist is practicing and his net income. (Fig. 4.) The average income of dentists practicing in communities of 1,000 population or less was $2,470. The income of dentists increased with the size of the community, reaching a maximum of $4,151 in communities of from 50,000 to 100,000 population. Of interest is the fact that income decreases in communities of more than 100,000 population, reaching an average of $3,907 net in communities of more than one-half million population. This decrease may possibly be accounted for in terms of overcrowding of the profession in metropolitan cities; a larger foreign-born population; the fact that there is a larger percentage of the population in the lower income brackets, and a larger percentage of dentists in the younger age brackets, and other such social and economic factors.

A very definite relationship is found to exist also between the net income and the age of the dentist. (Fig. 3.) The average net income of all dentists under the age of 25 years was $1,932. Income rose rapidly with age, reaching a maximum of $4,566 at the age level of from 40 to 44.

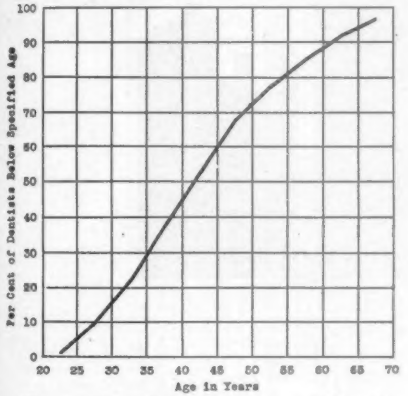


Fig. 2.—Cumulative percentage of dentists according to age for both income study sample and total dental population (1941). (The age distribution of the dentists included in the income sample is so similar to that of the total population as to make it impossible to show the two curves separately on a graph of this scale.)

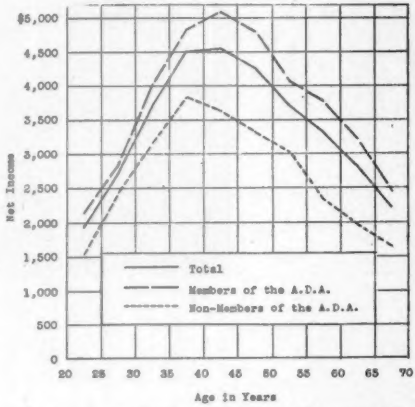


Fig. 3.—Average net income of dentists by age and membership in American Dental Association.

While the average income of dentists is of particular value and interest as a measure of economic status, important also is a knowledge of the distribution of income, since, obviously, an average figure on income is compounded from a wide range of incomes lying above and below the average figure. Table 5 presents what is called a quartile distribution of income. The dentists have been classified according to income and placed

here in four equal groups, ranging from the quarter having the lowest income to the quarter enjoying the highest income. From this analysis, which is shown graphically in Figures 5 and 6, it is found that 25 per cent of all members of the American Dental Association had incomes of less than $2,350 during the year 1941. The table shows a breakdown for various age groups in five year units. It is observed that 25 per cent of all members under 25 years of age received an income of less than $1,328, whereas 25 per cent of all members between the ages of 40 and 44, the years of maximum income, received less than $3,120 for that year. Fifty per cent of all members received incomes of less than $3,571, while half of all members under 25 years of age received less than $2,054. In the maximum income period of 40 to 44 years of age, half of all members of the American Dental Association received less than $5,306, while 75 per cent of all members under 25 years of age received less than $2,625 and 75 per cent of all members between 40 and 44 years of age received less than $6,358. The quarter of the profession in the highest income brackets received incomes greater than $5,306.

The income of non-members of the American Dental Association was relatively low. Twenty-five per cent of all non-members received incomes during 1941 of less than $1,495. Half of the non-members received less than $2,494, while 75 per cent of the non-members received less than $3,804.

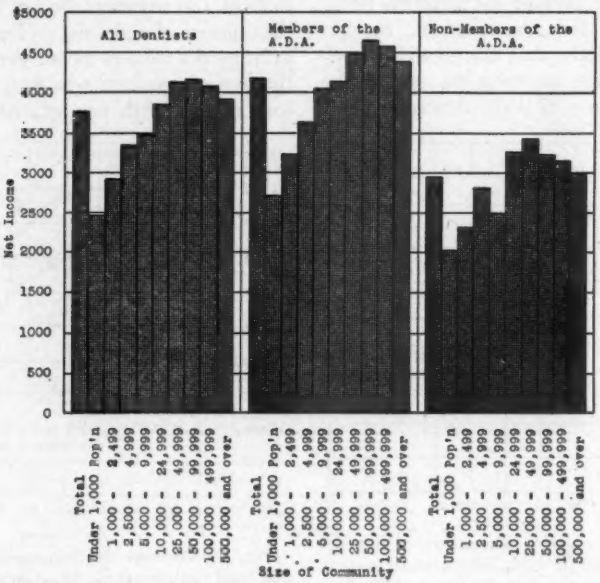


Fig. 4.—Average net income of dentists according to size of community in which practicing and membership in American Dental Association.

Type of Business Arrangement (Tables 6 and 7; Fig. 7).—In general, the practice of dentistry is carried out under one of four types of business arrangement: dentists in independent practice, working alone; dentists in independent practice and on a part-time salary basis; dentists working in group arrangements, and dentists receiving a salaried income only. Group arrangements include those situations where two or more dentists

share a common office with or without financial arrangements extending beyond sharing the cost of the rental of office space. Statistics on the distribution of dentists in these various types of business arrangement have been inadequate. This present survey offers data that may be useful in answering the question of the distribution of dentists by type of business arrangement. However, further study is needed before a positive statement can be made. It is found in the survey that 82.4 per cent of all dentists are in independent practice, working alone; 3.3 per cent are in independent practice with a part-time salary arrangement; 11.6 per cent are working in a group arrangement, and 2.7 per cent are working on a salary basis alone.

It is found, as would be expected, that a higher percentage of dentists in the smaller communities are engaged in independent practice alone than is true of dentists in the larger cities. Of all dentists working in communities of under 1,000 population, 94.7 per cent are in independent practice, working alone. This percentage decreases with the increase in size of the community. In cities of 500,000 or more population, 78.3 per cent of all dentists are engaged in this type of practice.

It is found that dentists working in a group arrangement have a slight advan-

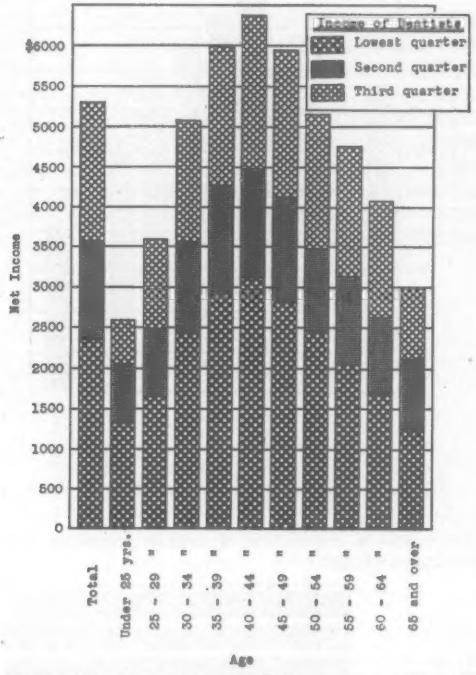


Fig. 5.—Quartile distribution of net income of dentists according to age for members of American Dental Association. The incomes of the dental population have been arranged in sequence from lowest to highest. This graph shows the range of income of dentists in the lowest quarter, the second quarter and the third quarter of the income brackets. The incomes of the 25 per cent of all dentists who are in the highest income bracket lie above the upper limit of the range shown in the graph.

tage with respect to income over men in other types of practice, the average net income of members working in group arrangements being $4,687 as compared with $4,325 for men in independent practice with a part-time salary; $4,135 for men in independent practice, working alone, and $3,369 for men receiving a salaried income only.

Years in Practice (Tables 7-10; Figs. 8-10).—Of all dentists participating in the income survey, 85.5 per cent are engaged in general practice, whereas 10.3 per cent designate their practice as partially specialized and 4.2 per cent state that their practice is wholly specialized. The percentage of dentists engaged in general practice varies with the size of the community, ranging from 97.5 per

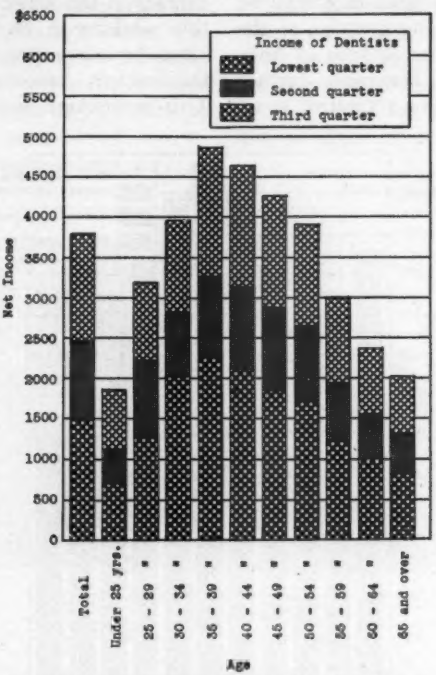


Fig. 6.—Quartile distribution of net income of dentists according to age for non-members of American Dental Association (1941).

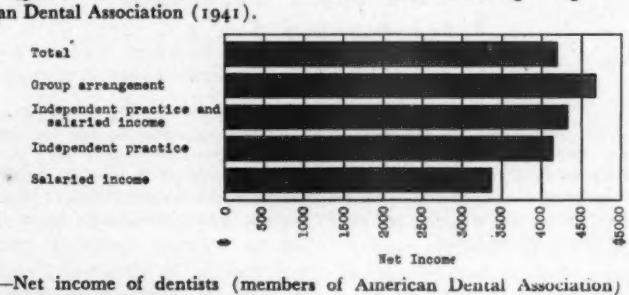


Fig. 7.—Net income of dentists (members of American Dental Association) according to type of business arrangement.

cent in communities under 1,000 population to a low of 80.1 per cent in communities of between 100,000 and 500,000 population. In communities of over 500,000 population, 84.4 per cent of all dentists are in general practice. (Table 8; Fig. 8.)

The average dentist whose practice is wholly specialized appears to have considerable advantage with respect to income over men in other types of practice. (Table 7.) Among members, the net income of the specialist in 1941 was $6,158. The dentist whose practice is partially specialized received an income of $4,716, while the general practitioner received an income of $4,008. Among non-members, the specialist earned an income of $5,472 as compared with $3,509 earned by the man whose practice is partially specialized and $2,866 by the man in general practice.

There exists, of course, a close correlation between average income and the number of years a dentist has been in practice. Since number of years in practice and age of the dentist are so closely related, the variation in income with years in practice follows a pattern very similar to that of income as related to age. The average income of all dentists in practice for less than five years was $2,595. Income increases with number of years in practice, reaching a maximum of $4,558 for the group who have been in practice from fifteen to nineteen years. After twenty years in practice, the income of the average dentist begins to decline, reaching a low of $2,071 for the group in practice forty-five years and over.

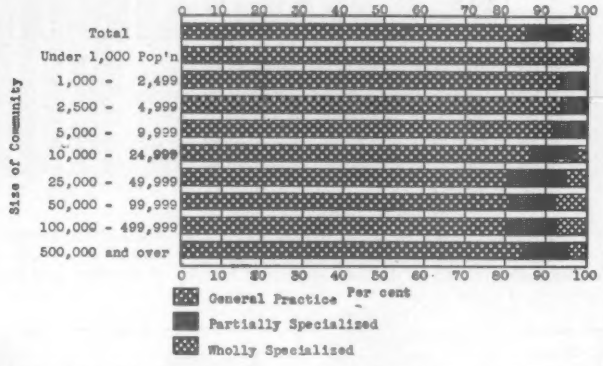


Fig. 8.—Distribution of dentists included in income study sample by type of practice and size of community (1941).

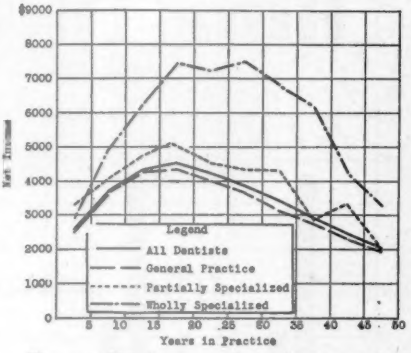


Fig. 9.—Net income of dentists in various types of practice by number of years in practice (1941) (all dentists).

The earning curve of men in different types of practice varies somewhat with number of years in practice. (Fig. 9.)

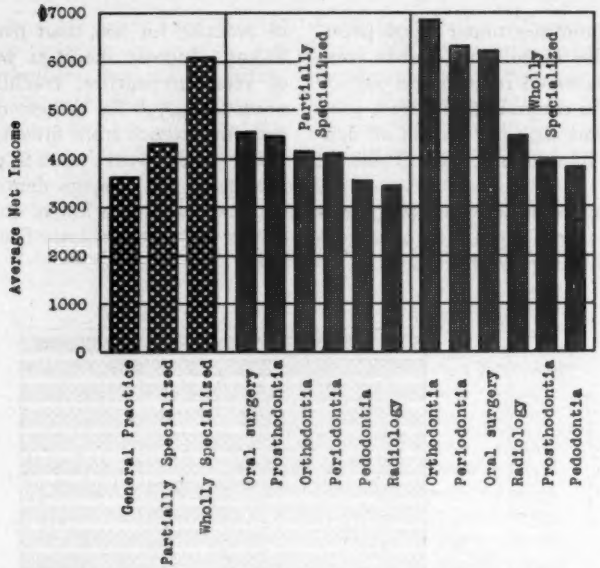


Fig. 10.—Average net income of dentists according to type of practice and type of specialization (1941).

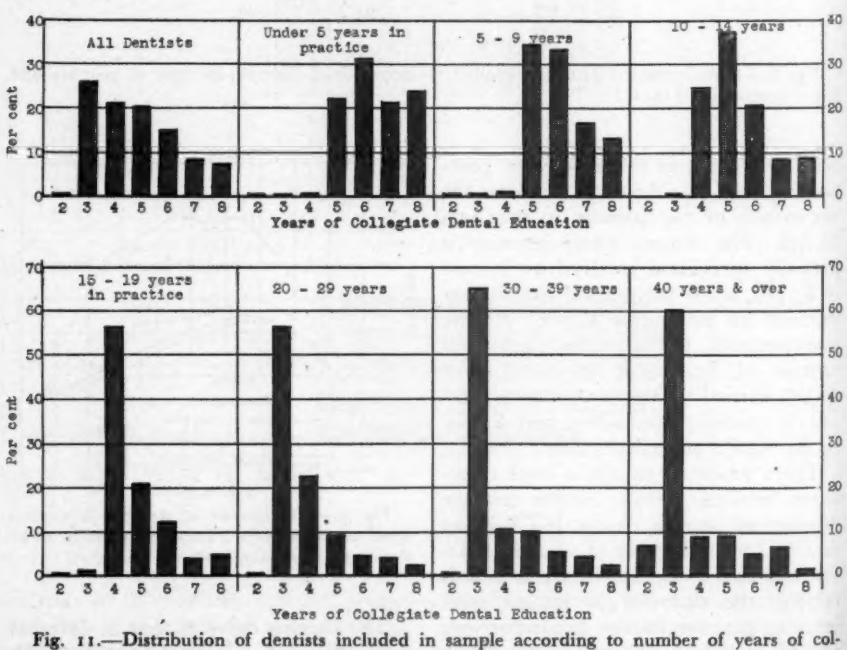

Per cent
All Dentists
Under 5 years in practice
5 - 9 years
10 - 14 years
2 3 4 5 6 7 8
Years of Collegiate Dental Education
15 - 19 years in practice
20 - 29 years
30 - 39 years
40 years & over

Fig. 11.—Distribution of dentists included in sample according to number of years of collegiate dental education and number of years in practice (members of American Dental Association).

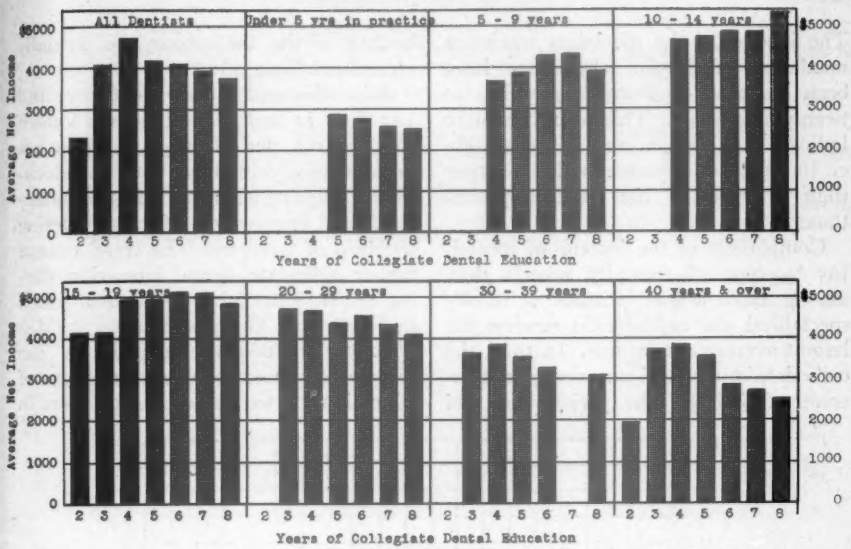


Fig. 12.—Average net income of dentists according to number of years of collegiate dental education and number of years in practice (members of American Dental Association).

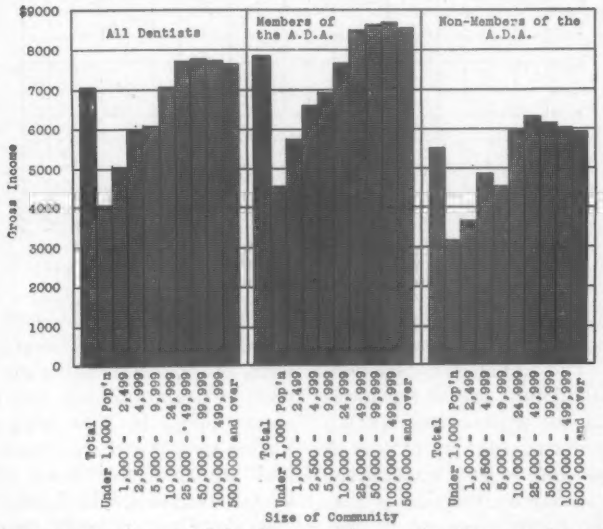


Fig. 13.—Average gross income of dentists according to size of community and membership in American Dental Association (1941).

The average income of the general practitioner with less than five years of service was $2,523, increasing to a maximum of $4,360 for the group having been in practice from fifteen to nineteen years. The dentist whose practice is wholly specialized and who has had less than five years' experience received $2,886.

The income of the specialists reaches a maximum of $7,560 when they have been in practice from twenty-five to twenty-nine years. This would seem to indicate that the specialist enjoys a higher income for a longer period of time than is true of the general practitioner.

Comparison of the income of specialists by type of specialty reveals that, among those whose practice is wholly specialized, the orthodontist receives the largest average net income. In 1941, the orthodontist received an average net income of $6,893. The periodontist and bottom of the list among the partially specialized ($3,477).

Education and Income (Tables 11 and 12; Figs. 11 and 12).—It is well known that, over a period of years, there has been a steady increase both in educational requirements and in voluntary academic preparation of men entering the field of dentistry. The trend toward higher collegiate dental education during recent years is clearly demonstrated in Figure 11. This graph shows the distribution of dentists included in the sample according to number of years of education related to number of years in

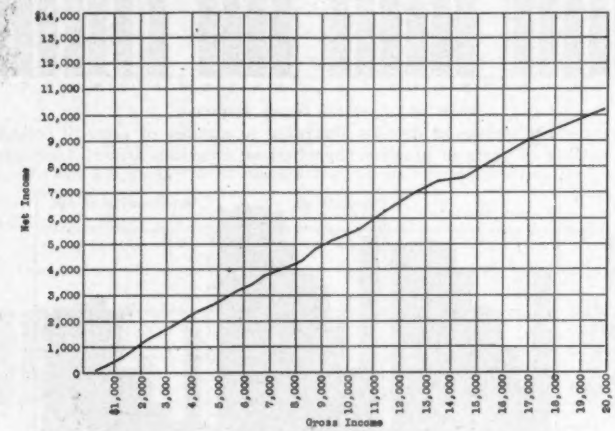


Fig. 14.—Average net income of dentists by gross income (1941).

the oral surgeon followed closely with an average income of $6,723 and $6,378, respectively. The radiologist, pedodontist and prosthodontist are at the lower end of the income scale among specialists, receiving during 1941 an income of $4,464, $3,650 and $3,625, respectively.

Among those whose practice is partially specialized, the sequence of specialties in terms of size of income differs slightly from that among those whose practice is wholly specialized. In this group, the oral surgeon enjoys the largest income ($4,612). However, he is closely rivaled by the prosthodontist ($4,545). The radiologist falls at the practice. It is to be noted that reference is made here to the total number of years of predental collegiate work and years of dental training. It is found that, among men who have been in practice for less than five years, almost none have had less than five years of collegiate dental education. The largest percentage (30) have had six years' training. Those men having five, seven and eight years' training are about evenly divided. Even among the men who have been in practice between five and nine years, there appears a marked difference in educational attainment as compared with that of the more recent graduates. A pre-

TABLE 1.—DISTRIBUTION OF ALL DENTISTS IN UNITED STATES AND OF DENTISTS PARTICIPATING IN INCOME SURVEY, ACCORDING TO GEOGRAPHIC AREA (1941)

Geographic Area	All Dentists		Income Study Sample	
	Number	Per Cent	Number	Per Cent
U. S. Total	77,510	100	13,489	100
New England	5636	7	857	6
Middle Atlantic	20,947	27	3492	26
East North Central	17,783	23	3306	25
West North Central	9635	12	1776	13
South Atlantic	6057	8	906	7
East South Central	2784	4	441	3
West South Central	4208	5	633	5
Mountain	2291	3	411	3
Pacific	8169	11	1667	12

TABLE 2.—DISTRIBUTION OF ALL DENTISTS IN UNITED STATES AND OF DENTISTS PARTICIPATING IN INCOME SURVEY, ACCORDING TO SIZE OF THE COMMUNITY IN WHICH PRACTICING (1941)

Size of Community	All Dentists		Income Study Sample	
	Number	Per Cent	Number	Per Cent
U. S. Total	77,510	100	13,489	100
Under 1000 population	3953	5	501	4
1000— 2499	6046	8	1010	7
2500— 4999	4806	6	914	7
5000— 9999	5348	7	1052	8
10,000— 24,999	7751	10	1422	11
25,000— 49,999	5968	7	1095	8
50,000— 99,999	6046	8	1108	8
100,000—499,999	13,719	18	2468	18
500,000 and over	23,873	31	3870	29
Unknown			49	

TABLE 3.—AGE DISTRIBUTION OF DENTISTS PARTICIPATING IN INCOME STUDY COMPARED WITH AGE DISTRIBUTION OF TOTAL DENTAL POPULATION (1941)

Age	All Dentists Per Cent	Income Study Sample Per Cent	Cumulative Percentage	
			All Dentists	Income Study Sample
Total	100.0	100.0		
Under 25	1.0	0.5	1.0	0.5
25—29	8.7	8.5	9.7	9.0
30—34	12.5	12.7	22.2	21.7
35—39	15.3	15.7	37.5	37.4
40—44	15.5	16.0	53.0	53.4
45—49	14.9	14.8	67.9	68.2
50—54	9.8	9.7	77.7	77.9
55—59	7.7	7.4	85.4	85.3
60—64	6.6	7.0	92.0	92.3
65 and over	8.0	7.7	100.0	100.0

TABLE 4.—AVERAGE NET INCOME OF DENTISTS IN UNITED STATES BY AGE ACCORDING TO MEMBERSHIP OR NON-MEMBERSHIP IN AMERICAN DENTAL ASSOCIATION AND ACCORDING TO SIZE OF COMMUNITY IN WHICH DENTIST PRACTICES (1941)

Size of Community	Total	Age									
		Under 25*	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65 and Over
All Dentists											
Total	$3773	$1932	$2726	$3733	$4503	$4566	$4287	$3722	$3330	$2823	$2230
Under 1000	2470		2595	2895	3051	3102	2832	2588	1995	1805	1353
1000— 2499	2914		2736	3436	3657	3241	3264	2577	2571	2233	1888
2500— 4999	3357		3435	3785	4052	3896	3590	3466	2726	2548	1702
5000— 9999	3498		3061	3680	4136	3755	3517	3232	3069	2206	1838
10,000— 24,999	3842		2809	4143	4597	4865	4612	3543	2929	2826	2145
25,000— 49,999	4112		2685	4133	4952	4997	4651	4519	3343	2779	2326
50,000— 99,999	4151		2913	4164	4883	5287	4566	4174	3972	2927	2353
100,000—499,999	4087		2650	3860	5085	5132	4611	3928	3495	3196	2320
500,000 and over	3907		2457	3452	4476	4677	4601	3936	3765	3081	2571
Members											
Total	4177	2146	2846	4022	4831	5097	4806	4085	3789	3233	2429
Under 1000	2709		2868	2840	3173	3363	3141	2475	2235	1950	1564
1000— 2499	3237		2572	3552	3827	3469	3626	2933	2741	2812	2120
2500— 4999	3644		3110	4028	4279	4327	3919	3550	3041	3032	1914
5000— 9999	4040		3120	4036	3523	4175	3996	3366	3505	2570	2173
10,000— 24,999	4138		2944	4231	5123	5122	5011	3767	3384	3044	2269
25,000— 49,999	4476		2743	4281	5026	5510	5240	5026	3729	3440	2467
50,000— 99,999	4645		3451	4669	5086	5876	5288	4594	4203	3250	2738
100,000—499,999	4579		2720	4367	5367	5586	5100	4394	4133	3919	2454
500,000 and over	4394		2593	3698	4941	5307	5151	4409	4609	3426	2965
Non-Members											
Total	2941	1528	2459	3178	3801	3645	3332	3033	2351	1965	1633
Under 1000	2021		2083	3000	2821	2611	2250	2800	1544	1533	955
1000— 2499	2305		3044	3219	3336	2812	2583	1908	2250	1143	1450
2500— 4999	2817		4045	3327	3625	3083	2971	3309	2135	1639	1304
5000— 9999	2479		2950	3011	3408	2964	2615	2979	2250	1521	1207
10,000— 24,999	3285		2553	3977	3607	4381	3861	3120	2074	2417	1911
25,000— 49,999	3428		2575	3856	4814	4032	3542	3566	2617	1536	2060
50,000— 99,999	3223		1900	3212	4500	4177	3207	3382	3539	2318	1629
500,000—499,999	3159		2518	2906	4556	4277	3691	3049	2293	1835	2068
500,000 and over	2990		2202	2989	3600	3490	3566	3047	2178	2430	1829

*The number of dentists under 25 years of age reporting on their income was so small that average figures for anything other than the totals are not reliable.

ponderance of the men in this group had only five or six years of dental education, while a comparatively small number have had seven or eight years of training. In moving up to the group who have been in practice for from ten to fourteen years (i.e., the group who graduated between 1926 and 1931), it is

found that a relatively high percentage finished only four or five years' training (25 per cent and 37 per cent, respectively). Only a very small percentage have been in practice between thirty and thirty-nine years (graduates of 1901 to 1906), more than 65 per cent received only three years' training, while only a

TABLE 5.—DISTRIBUTION* OF INCOME OF DENTISTS (MEMBERS AND NON-MEMBERS OF AMERICAN DENTAL ASSOCIATION) BY AGE (1941)

Age	Members of the American Dental Association			Non-Members of the American Dental Association		
	25% of Incomes Were Under	50% of Incomes Were Under	75% of Incomes Were Under	25% of Incomes Were Under	50% of Incomes Were Under	75% of Incomes Were Under
All Ages	$2350	$3571	$5306	$1495	$2494	$3804
Under 25	1328	2054	2625	708	1125	1875
25—29	1659	2494	3599	1284	2217	3195
30—34	2425	3556	5085	2016	2829	3963
35—39	2968	4241	6007	2270	3286	4888
40—44	3120	4470	6358	2117	3111	4620
45—49	2824	4126	5940	1843	2891	4250
50—54	2454	3481	5167	1726	2648	3906
55—59	2077	3138	4776	1207	1950	3025
60—64	1739	2622	4073	1019	1557	2367
65 and over	1264	2103	3039	809	1325	2010

*Quartile distribution. (See footnote, Fig. 5.)

TABLE 6.—PERCENTAGE DISTRIBUTION OF DENTISTS PARTICIPATING IN INCOME STUDY, ACCORDING TO TYPE OF BUSINESS ARRANGEMENT, AND BY SIZE OF COMMUNITY (1941)

Size of Community	Business Arrangement			
	Independent Practice Alone	Salaried Income Alone	Independent Practice and Salary	Group Arrangements
Total	82.4	2.7	3.3	11.6
Under 1000 population	94.7	1.5	0.9	2.9
1000— 2499	93.1	1.3	0.7	4.9
2500— 4999	87.5	2.6	2.2	7.7
5000— 9999	87.3	1.4	2.9	8.4
10,000— 24,999	82.7	3.1	2.8	11.4
25,000— 49,999	84.2	2.6	2.4	10.8
50,000— 99,999	83.5	3.0	2.7	10.8
100,000—499,999	77.2	3.4	3.4	16.0
500,000 and over	78.3	2.5	5.3	13.9

(approximately 8) of this group have had seven or eight years' training. This movement toward a lower educational status for men who have been in practice for longer periods of time continues until it is found that among men who negligible number received more than five years of training.

The number of years spent in collegiate and dental education also appears to be a factor in determining income. Because of the rapid change in educa-

TABLE 7.—AVERAGE NET INCOME OF DENTISTS BY TYPE OF BUSINESS ARRANGEMENT AND TYPES OF PRACTICE FOR MEMBERS AND NON-MEMBERS OF AMERICAN DENTAL ASSOCIATION (1941)

Type of Business Arrangement	Members				Non-Members			
	Total	Type of Practice			Total	Type of Practice		
		General	Partially Specialized	Wholly Specialized		General	Partially Specialized	Wholly Specialized
Total	$4190	$4008	$4716	$6158	$2971	$2866	$3509	$5472
Group arrangement	4687	4470	4875	6875	3800	3642	4500	5364
Independent practice and salaried income	4325	3931	5395	5870	3286	3250	3191	5500
Independent practice	4135	3960	4738	6597	2857	2765	3423	5819
Salaried income	3369	3308	3326	3525	3735	3572	3607	4687

tional requirements during the last two decades, it is essential that the number of years in practice be held constant in making this analysis. When this is done, it is found that among men who have been in practice for less than fifteen years, there is a slight tendency for income to be larger among those having had more academic work. However, among the groups that have been in practice for twenty years or more, there is found to exist a clearly marked negative correlation between education and income. The data seem to suggest that men entering practice during the early part of this century did not find it essential to economic success to have back of them a long experience in the academic field. However, the indications are that education is becoming of increasing importance to the dentist in an economic sense.

GROSS INCOME OF DENTISTS

Size of Community and Membership in the American Dental Association (Table 13; Fig. 13).—While the figures on net income are the more interesting to the average dentist, since they represent his profits, equally important in an analysis of dental practice as a business is information regarding gross income. In the income survey questionnaire, the dentist was asked to give his gross income, the costs of conducting his practice and his net income. From these data, it is found that, in 1941, the average dentist received a gross income of $7,020. Members of the American Dental Association received a gross income

TABLE 8.—PERCENTAGE DISTRIBUTION OF DENTISTS PARTICIPATING IN INCOME STUDY, ACCORDING TO TYPE OF PRACTICE AND BY SIZE OF COMMUNITY (1941)

Size of Community	Type of Practice		
	General	Partially Specialized	Wholly Specialized
Total	85.5	10.3	4.2
Under 1000 population	97.5	2.3	0.2
1000—2499	93.9	5.4	0.7
2500—4999	94.0	5.2	0.8
5000—9999	92.0	7.4	0.6
10,000—24,999	86.1	11.8	2.1
25,000—49,999	80.6	14.5	4.9
50,000—99,999	80.9	11.6	7.5
100,000—499,999	80.1	12.4	7.5
500,000 and over	84.4	11.1	4.5

TABLE 9.—AVERAGE NET INCOME OF DENTISTS BY NUMBER OF YEARS IN PRACTICE (MEMBERS AND NON-MEMBERS) AND AVERAGE NET INCOME OF ALL DENTISTS BY TYPE OF PRACTICE (1941)

Years in Practice	All Types of Practice			Types of Practice		
	Total	Members	Non-Members	General	Partially Specialized	Wholly Specialized
Under 2	$1928	$2037	$1725	$1892	$1970	$2726
2	2223	2493	1722	2084	3890	2775
3	2910	3068	2618	2879	3768	2599
4	3228	3345	3011	3169	3448	3670
Under 5	$2595	$2691	$2417	$2523	$3305	$2886
5	$3322	$3758	$2511	$3290	$3170	$4045
6	3785	3976	3431	3739	4548	3642
7	3735	3996	3250	3627	4366	4729
8	3976	4354	3273	3896	3844	7708
9	3966	4279	3385	3844	3872	6396
Under 10	$3766	$4074	$3193	$3692	$4108	$4949
10—14	$4368	$4808	$3552	$4239	$4798	$6230
15—19	4558	4992	3753	4360	5143	7447
20—24	4245	4788	3238	4056	4583	7232
25—29	3868	4344	2984	3649	4398	7560
30—34	$3437	$3916	$2547	$3173	$4380	$6824
35—39	2936	3368	2133	2771	2941	6217
40—44	2485	2836	1834	2300	3384	4250
45 and over	2071	2347	1559	1925	2130	5953

TABLE 10.—AVERAGE NET INCOME OF DENTISTS BY TYPE OF PRACTICE AND TYPE OF SPECIALIZATION ACCORDING TO MEMBERSHIP OR NON-MEMBERSHIP IN AMERICAN DENTAL ASSOCIATION (1941)

Specialty	All Specialists		Members		Non-Members	
	Partially Specialized	Wholly Specialized	Partially Specialized	Wholly Specialized	Partially Specialized	Wholly Specialized
Oral surgery	$4612	$6378	$4829	$6501	$3923	$4979
Orthodontia	4347	6893	4710	6908	3066	6750
Periodontia	4307	6723	4589	6323	3137	10,125
Prosthodontia	4545	3625	4984	4194	3425	2600
Pedodontia	3728	3650	3915	3578	2850	5500
Radiology	3477	4464	3687	4464	2917	
Other						

of $7,833 as compared with a gross of $5,510 received by non-members.

Gross income varied sharply with the size of the community. In communities of less than 1,000 population, the average gross income of all dentists was $4,064. The gross income increased steadily with the size of the community, reaching a maximum of $7,765 in communities of from 50,000 to 100,000 population. In communities having a larger population, the average gross income of dentists decreased slightly to $7,634 in communities having a population of more than one-

half million. Among members practicing in communities of less than 1,000 population, the average gross was $4,533. The maximum gross of $8,672 was received by members practicing in communities of from 100,000 to 500,000 population. Among non-members, the average gross of dentists practicing in communities of less than 1,000 population was $3,193.

TABLE 11.—PERCENTAGE DISTRIBUTION OF DENTISTS (MEMBERS AND NON-MEMBERS OF AMERICAN DENTAL ASSOCIATION), ACCORDING TO YEARS OF EDUCATION AND BY NUMBER OF YEARS IN PRACTICE (1941)

Years of Education	Years in Practice							
	Total	Under 5	5-9	10-14	15-19	20-29	30-39	40 and Over
All Dentists								
Under 2	0.6	0.1	0.1		0.1	0.1	0.7	7.1
3	26.0	0.1	0.3	0.6	1.2	56.2	65.5	60.1
4	21.4	0.7	1.3	24.5	56.2	22.8	10.7	9.4
5	20.7	22.2	34.5	37.4	21.1	9.9	10.5	9.7
6	15.3	31.4	33.5	20.7	12.4	4.5	5.7	5.2
7	8.5	21.5	16.7	8.1	4.0	4.2	4.7	6.7
8 and over	7.5	24.0	13.6	8.7	5.0	2.2	2.2	1.8
Members								
Under 2	0.5				0.1		0.7	6.9
3	25.7	0.1	0.3	0.4	1.0	56.9	68.0	61.3
4	22.0	0.6	1.3	24.9	56.0	23.6	10.2	9.1
5	21.4	22.8	36.8	38.2	21.2	10.2	10.0	9.8
6	15.2	31.7	34.3	20.6	12.8	3.8	4.9	3.8
7	7.9	20.7	14.5	7.7	4.0	3.7	4.4	7.2
8 and over	7.3	24.1	12.8	8.2	4.9	1.8	1.8	1.9
Non-Members								
Under 2	0.8	0.3	0.2			0.3	0.7	7.4
3	26.7		0.5	1.2	2.1	54.2	59.3	57.2
4	19.8	0.9	1.2	23.0	57.1	20.6	11.8	10.3
5	18.6	20.4	28.1	35.1	20.3	9.1	11.8	9.5
6	15.5	30.2	31.3	21.1	11.3	6.6	7.7	8.2
7	10.2	24.4	22.7	9.0	3.9	5.8	5.6	5.8
8 and over	8.4	23.8	16.0	10.6	5.3	3.1	3.1	1.6

A maximum gross of $6,295 was received by dentists practicing in communities of from 25,000 to 50,000 population.

Net Income by Gross Income (Table 14; Fig. 14).—It is of particular interest to note the relationship between gross income and net income. In Table 14, gross incomes are presented in class intervals of $500. The average net income of the men receiving gross incomes within the range of each of these class intervals is presented. In turn, net income as a percentage of gross income is given. To cite a few examples of the average net income according to gross income, it is found that men having a gross income of less than $500 had an average net income of $77. Dentists having a gross income of between $1,500 and $2,000 received an average net income of $986. Those receiving between $4,000 and $4,500 gross income received a net of $2,413. Those receiving a gross of $6,500 to $7,000 netted $3,745. Those grossing between $9,000 and $10,000 netted

$5,171, while those grossing $20,000 or more netted $13,169.

It is particularly interesting to note that the percentage of gross income which is realized as net income varies but little regardless of the size of the gross income. While net income is proportionately small for gross incomes of less than $1,500, for all gross income groups of $1,500 and over net income ratio to gross income through almost the entire scale of gross income.

Net Income—1937-1941 (Table 15).—While the major emphasis of the survey was on the incomes for the year 1941, the dentists reporting were asked to give information on income for earlier years. From these figures and from figures obtained from a survey conducted by the Department of Com-

TABLE 12.—NET INCOME OF DENTISTS BY NUMBER OF YEARS OF COLLEGIATE EDUCATION AND TYPE OF COLLEGIATE EDUCATION, AND BY NUMBER OF YEARS IN PRACTICE, FOR MEMBERS AND NON-MEMBERS OF AMERICAN DENTAL ASSOCIATION (1941)*

Years of Collegiate Dental Education	Total	Years in Practice						
		Under 5	5-9	10-14	15-19	20-29	30-39	40 and Over
Members								
Under 3	$2312							$1936
3	4063				$4150	$4711	$3610	2773
4	4691		$3667	$4627	4968	4663	3811	2810
5	4198	$2859	3860	4756	4967	4351	3559	2561
6	4144	2770	4280	4864	5106	4542	3259	2837
7	3942	2596	4326	4856	5086	4313	4939	2709
8 and over	3741	2506	3883	5370	4828	4075	3079	2525
Non-Members								
Under 3	$1946							$1469
3	2633				$2975	$3108	$2463	1732
4	3450			$3678	3777	3350	2872	1646
5	3123	$2636	$3241	3328	3847	3310	2087	1641
6	3199	2457	3248	3790	4115	3321	2267	1645
7	3017	2493	3110	3901	2983	3244	3284	1904
8 and over	2655	2085	3172	3411	2906	2312	1500	

*In instances where the returns were too few to give reliable results, averages were not computed.

remains almost a constant of about 55 per cent. In other words, net income as a percentage of gross income remains proportionately the same through a wide range of gross income brackets.

Obviously, the percentage of gross income not included in net income represents costs of practice. It is significant, therefore, that the cost of conducting a practice remains in an almost constant

merce during the year 1939, we are able to obtain figures on comparative income for the years 1937, 1939 and 1941 that are significant. (Table 15.) The average net income in 1937 for all dentists was $2,914. Income increased, reaching a level of $3,328 in 1939 and continuing to increase to $3,773 in 1941. Both the members and the non-members of the American Dental Association experi-

enced increases in their incomes. The average income of members in 1937 was $3,386, increasing to $3,728 in 1939 and to $4,177 in 1941. Among non-members, the income increased from $2,177 in 1937 to $2,584 in 1939 and to $2,941 in 1941. These increases in the net income of the dental profession followed closely the improvement in the economic situation of the country as a whole.

Experience has shown that fee schedules for dental care change very slowly in response to changes in the general economic level. Thus, the increase in dental income must be explained for the most part by an increasing demand for dental service. This fluctuation of dental income with general economic conditions clearly indicates that dental care is not yet considered an essential in the budget planning of the average American family; since the public demand for the essentials of life ordinarily fluctuates but slightly.

Since the average gross income of dentists in 1941 was approximately $7,000 and the number of practicing dentists was more than 70,000, it is concluded that, during the year 1941, the American public expended approximately $500,000,000 for dental service. This figure represents about one-half of 1 per cent of the national income.

TABLE 13.—AVERAGE GROSS INCOME OF DENTISTS (MEMBERS AND NON-MEMBERS OF AMERICAN DENTAL ASSOCIATION), ACCORDING TO SIZE OF COMMUNITY (1941)

Size of Community	All Dentists	Total Members	Total Non-Members
Total	$7020.35	$7833.45	$5510.31
Under 1000 population	4063.62	4532.61	3192.63
1000— 2499	5013.13	5738.15	3666.67
2500— 4999	5993.76	6614.28	4841.38
5000— 9999	6072.69	6890.11	4554.63
10,000— 24,999	7063.15	7637.09	5997.26
25,000— 49,999	7736.79	8513.28	6294.74
50,000— 99,999	7765.13	8643.95	6133.03
100,000—499,999	7749.49	8672.39	6035.54
500,000 and over	7633.78	8559.67	5914.26
Not given	7100.57	8568.18	4375.00

TABLE 14.—AVERAGE NET INCOME OF DENTISTS BY GROSS INCOME (1941)

Gross Income	Average Net Income	Net Income as Percentage of Gross Income
$ 0— 499	$ 76.65	30.66
500— 999	331.85	44.25
1000— 1499	637.90	51.03
1500— 1999	985.90	56.34
2000— 2499	1,261.95	56.09
2500— 2999	1,549.25	56.34
3000— 3499	1,834.90	56.46
3500— 3999	2,130.25	56.81
4000— 4499	2,413.45	56.79
4500— 4999	2,672.50	56.26
5000— 5499	2,926.80	55.75
5500— 5999	3,204.60	55.73
6000— 6499	3,453.55	55.26
6500— 6999	3,745.30	55.49
7000— 7499	3,952.65	54.52
7500— 7999	4,156.35	53.63
8000— 8499	4,395.45	53.28
8500— 8999	4,834.55	55.25
9000— 9999	5,171.15	54.43
10,000—10,999	5,638.05	53.70
11,000—11,999	6,323.80	54.99
12,000—12,999	6,987.15	55.90
13,000—13,999	7,491.55	55.49
14,000—14,999	7,523.90	51.89
15,000—19,999	9,000.60	51.43
20,000 and over	13,169.50	58.53

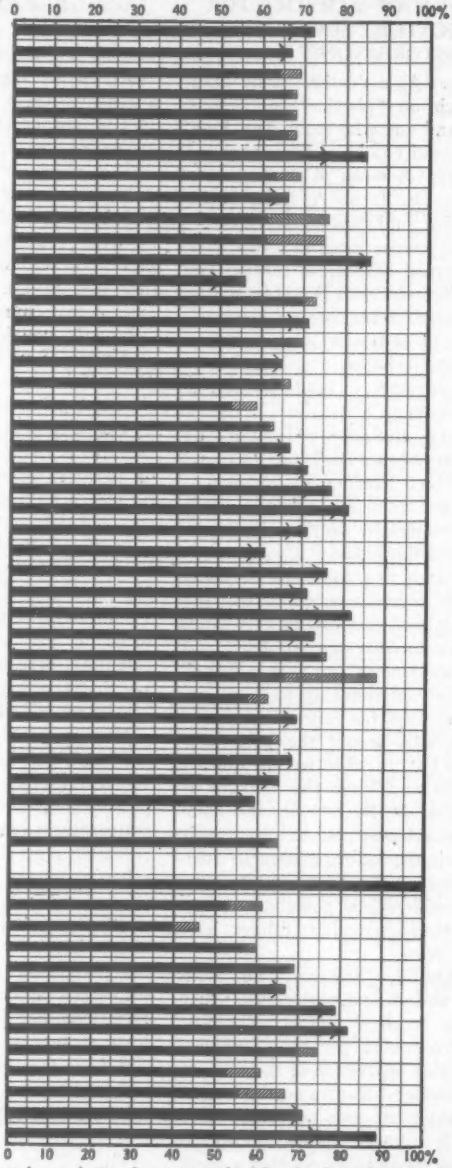
TABLE 15.—AVERAGE NET INCOME OF DENTISTS (MEMBERS AND NON-MEMBERS OF AMERICAN DENTAL ASSOCIATION) FOR YEARS 1937-1939-1941

Year	Total	Members	Non-Members
1937*	$2914	$3386	$2177
1939	3328	3728	2584
1941	3773	4177	2941

*Income data for the year 1937 taken from "Economic Conditions in the Dental Profession 1929-37" by Herman Lasken, National Income Section, Department of Commerce.

Membership Page

PERCENTAGE OF DUES RECEIVED IN CENTRAL OFFICE AS OF SEPTEMBER 30, 1943, AS COMPARED TO 1942 MEMBERSHIP



	MEMBERS
ALABAMA	433
ARIZONA	99
ARKANSAS	246
CALIFORNIA	1,911
SOUTHERN CALIFORNIA	2,139
COLORADO	491
CONNECTICUT	1,031
DELAWARE	69
DISTRICT OF COLUMBIA	431
FLORIDA	477
GEORGIA	513
HAWAII	188
IDAHO	123
ILLINOIS	4,894
INDIANA	1,370
IOWA	1,205
KANSAS	654
KENTUCKY	585
LOUISIANA	473
MAINE	244
MARYLAND	512
MASSACHUSETTS	2,243
MICHIGAN	2,197
MINNESOTA	1,831
MISSISSIPPI	265
MISSOURI	1,616
MONTANA	223
NEBRASKA	658
NEVADA	47
NEW HAMPSHIRE	174
NEW JERSEY	2,185
NEW MEXICO	87
NEW YORK	6,794
NORTH CAROLINA	611
NORTH DAKOTA	171
OHIO	2,796
OKLAHOMA	485
OREGON	487
PANAMA	0
PENNSYLVANIA	4,227
PHILIPPINE ISLANDS	0
PUERTO RICO	145
RHODE ISLAND	217
SOUTH CAROLINA	168
SOUTH DAKOTA	175
TENNESSEE	605
TEXAS	1,468
UTAH	237
VERMONT	117
VIRGINIA	618
WASHINGTON	728
WEST VIRGINIA	387
WISCONSIN	1,627
WYOMING	105

Percentage based on dental population figures supplied by the State Society Secretaries.

1943 percentage 1942 percentage

CORRESPONDENCE

"EVALUATION OF ACRYLICS FOR MASTICATORY-SURFACE RESTORATIONS"

To the Editor: As a dentist wholly occupied in research on "plastics" for surgery and dentistry, and one who reads THE JOURNAL with relish and continual benefit, may I presume to reply to some of the misstatements made by Dr. Jacob A. Saffir in his article on acrylics published in December.

It is right and proper for us to accept each new dental material with great caution and to postpone judgment until it has been subjected to prolonged trials, but no service is rendered to the profession by such criticisms as those made by Dr. Saffir.

His adverse criticism is made under the headings of "Hardness," "Stability," "Chemicals" (including toxicity), "Temperature Effects," "Water Absorption" and "Color." He gives the Brinell hardness of the resin as 18-20, but must know that it can easily reach 30 for enameloid acrylics. "Portex" dentin can exceed this figure.

He then proceeds to compare it adversely with pure gold, which is much harder, but still too soft for most restorations. He omits all reference to ductility and resilience. A heavy duty rubber motor tire with a Brinell figure below 5 would stand up to thousands of miles of road work far better than a pure gold tire. Not only would the gold wear more rapidly, but it also would quickly flatten, lengthen and leave the vehicle. If Dr. Saffir is in doubt, let him file and hammer tire rubber and pure gold simultaneously and see which is the more resistant to attrition, etc. Hardness is by no means the only factor to be considered, as porcelain restorations and synthetic porcelain fillings have shown, to their cost.

Under the heading "Stability," Dr. Saffir stresses the expansion and contraction which may occur in acrylics, giving volumetric fluctuations of 0.12-0.22 per cent, implying that this will cause separation of the cementing medium. I suggest that he process a good enameloid acrylic at low heat and high pressure until it acquires a molecular weight of 90,000. Tests for stability on such a product will greatly reassure him.

As for chemical properties and toxicity, the diabetic patient who produces an excess of acetone by means of which he softens and "eats up his acrylic teeth" should be very grateful to them for having drawn attention to a serious, untreated condition and thereby saving his life.

The monomeric liquid is not a highly poisonous compound. My fellow workers and I have lived in its concentrated vapor for four years, often underground because of war conditions. We have sometimes been drenched to the skin with the liquid and have daily inspired and ingested enough fine polymeric powder to suffice for a denture, and none of us has suffered a day's illness. Dr. Saffir's suggestion that minute particles of the inert polymer, abraded from acrylic teeth by mastication and then swallowed, will prove harmful is ludicrous. Silicosis from ingestion of particles of porcelain teeth and fillings or mercurial poisoning from amalgam fillings and vulcanite is far more likely to occur.

With regard to temperature effects, Dr. Saffir has allowed his imagination to run riot. He states that the resin may soften at 120° F., and that some of us eat food and chew steaks at this temperature (I wish such a restaurant existed in London). He goes on to say that acrylic may revert to its liquid state "under proper conditions."

No appreciable softening (of even poorly processed acrylic resin) takes place below 140° F., and "proper conditions" for depolymerization into monomeric liquid are temperatures between 400° and 500° F. Incidentally, acrylics can be made to resist softening at the boiling point. Dimensional change induced in methyl methacrylate by water absorption and absorption of acids and alkalis has been shown to be negligible and the permanent effect nil. Dr. Rinker and his collaborators used the industrial resin for their tests, and it seems that we have yet to learn to process acrylics for dental use.

I agree that color instability is still a problem and further research is needed.

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OBITUARY

GUY LOUIS SPENCER, D.D.S.
(1893-1943)

GUY LOUIS SPENCER died at the Lincoln General Hospital, Lincoln, Nebr., July 15, his death following an illness of several months. So passes into history a distinguished and lovable character who gave to dentistry and his community every available ounce of his resources. Dr. Spencer's death leaves a vacancy in the activities of Nebraska dentistry which it will be difficult to fill. His friendly handshake and his winning smile will long be remembered by his host of friends.

GUY L. SPENCER, D.D.S.

Dr. Spencer was born in Pesotum, Ill., and came to Hebron, Nebr., with his parents at the age of 8. Here he received his high school education. He began his college career at Wesleyan University, and later transferred to the University of Nebraska to study dentistry. He received his dental degree in 1916. He began private practice at Polk, Nebr., and in 1919 moved to Lincoln, locating at University Place. He was associated with Dr. Mark E. Vance for several years.

While in dental college, he became a member of Delta Sigma Delta. He served Beta Beta Chapter as its Deputy for many years, and was Grand Master of the Nebraska auxiliary. In 1941, he was made Supreme Grand Master of Delta Sigma Delta, the second Nebraskan to receive this honor.

Dr. Spencer served Nebraska dentistry in many ways. He was a past president of the Lincoln District Dental Society and was treasurer of the Nebraska State Dental Association from 1924 to 1938. He became president elect in 1938-1939, and served as president in 1939-1940. He was a delegate or an alternate to the American Dental Association many times and was a regular attendant at all the meetings of organized dentistry. From 1931 to 1943, he was a member of the dental faculty of the University of Nebraska, where his subjects were (1) dental history and literature and (2) gold foil. He was a life member of the Woodbury Study Club and a member of the American College of Dentists.

Dr. Spencer was a Scottish Rite Mason and a past Patron of O. E. S., and a member of the Scottish Rite Octet and the Shrine Band since 1926. He belonged to the Shrine Symposium Club. He was a past president of the Lincoln Kiwanis Club and a member of the Lincoln Chamber of Commerce. For many years, he maintained membership in the Methodist Church.

Dr. Spencer was married to Dorothy Irene Harding in 1915. He is survived by Mrs. Spencer, two daughters and a sister.

Funeral services were held July 20 at the St. Paul Methodist Church, Lincoln, Nebr., with interment at Wyuka.

PAUL G. LUDWICK.

DEATHS

ALLEN, WILLIAM ORWIN, Billings, Mont.; Northwestern University Dental School, 1897; died September 6; aged 70.

ANDREE, HENRY F., Chicago, Ill.; died August 2.

AXELROD, SAMUEL E., Chicago, Ill.; Chicago, Ill.; Chicago College of Dental Surgery, 1917; died September 22.

BARTMANN, GEORGE H., Madera, Calif.; San Francisco College of Medicine and Surgery, Dental Department, 1906; died September 11; aged 57.

BERGAN, EUGENE L., Minneapolis, Minn.; University of Minnesota, College of Dentistry, 1920; died September 16; aged 46.

BOWYER, W. C., Lebanon, Ohio; Ohio College of Dental Surgery, Dental Department of the University of Cincinnati, 1895; died September 6; aged 77.

BRAHMS, BENJAMIN I., Lawrence, L. I.; College of Dental and Oral Surgery of New York, 1910; died September 5; aged 61.

BRIDGE, WALTER G., Morrisville, Vt.; Tufts College Dental School, 1901; died August 21; aged 69.

BRYAN, C. H., Brigham City, Utah; University of Louisville, School of Dentistry, 1907; died August 22; aged 62.

BURNHAM, ALLEN S., Ipswich, Mass.; Harvard University Dental School, 1892; died September 5; aged 71.

CALDWELL, JAMES M., Brooklyn, N. Y. (formerly of Lewiston, Maine); Thomas W. Evans Museum and Dental Institute School of Dentistry, University of Pennsylvania, 1919; died July 19; aged 44. Dr. Caldwell held the rank of Assistant Dental Surgeon in the United States Health Service.

CANNON, H. M., Butler, Mo.; Western Dental College, 1898; died July 28.

CARR, JOSEPH L., University of Buffalo, School of Dentistry, 1918; died September 19.

CHRISTIANSEN, ELMER E., Panguitch, Utah; Georgetown University, School of Dentistry; died June 27; aged 61.

CLARK, EDWARD WARREN, Wichita, Kan.; Western Dental College, 1895; died August 12; aged 76.

DEAN, ASA W., Medina, Ohio; Western Reserve University, School of Dentistry, 1917; died August 26; aged 48.

DINGLER, HOWARD R., Royal Oak, Mich.; University of Michigan, College of Dentistry, 1915; died September 12; aged 52.

ELLIS, A. H., Providence, Ky.; University of Louisville, School of Dentistry, 1916; died July 20; aged 50.

FINN, GEORGE J., Bridgeport, Conn.; Temple University School of Dentistry, 1911; died July 25; aged 58.

FISHER, HUGO G., Chicago, Ill.; Northwestern University Dental School, 1896; died in Merion, Pa., September 18; aged 68.

GRAY, BENNETT, Perth Amboy, N. J.; University of Maryland, School of Dentistry and the Baltimore College of Dental Surgery, 1908; died September 13; aged 67.

GREEN, GRANT A., Grangeville, Idaho; North Pacific College of Oregon, School of Dentistry, 1898; died September 1; aged 71.

HENRY, SYLURUS A., Wheaton, Ill.; Northwestern College of Dental Surgery, 1894; died September 17; aged 76.

HESSLER, WILLIAM C., Crawfordsville, Ind.; Chicago College of Dental Surgery, 1895; died September 6; aged 75.

HIGINBOTHAM, URIAH FINLEY, Fayette City, Pa.; University of Pittsburgh, School of Dentistry, 1927; died September 8; aged 38.

HOWARD, H. A., Shelton, Nebr.; University of Nebraska, College of Dentistry, 1918; died September 1; aged 48.

JAMES, FRANK S., Winona, Minn.; University of Michigan, College of Dentistry, 1893; died September 13; aged 73.

JOHNS, SAMUEL H., Wilmington, Del.; Temple University School of Dentistry, 1895; died September 16; aged 83.

KURTZ, CYRUS, Paterson, N. J.; University of Maryland, School of Dentistry and the Baltimore College of Dental Surgery, 1899; died July 24; aged 73.

LANGLOIS, RODNEY ROBERT, Seattle, Wash.; North Pacific College of Oregon, 1925; died August 22, from injuries received in a fall down the basement stairs in his home. Dr. Langlois was 41 years old.

INCIDENTS OF PRACTICE

Removal of One Impacted Tooth Versus Removal of Three or Four Impacted Teeth

By Victor H. Frank, D.D.S., Philadelphia, Pa.

There has been much discussion regarding the advisability of removing more than one impacted tooth at a time. The various factors in the decision to remove one or more are:

1. The general physical condition.
2. The oral condition, with consideration of possible (a) pericoronal infection, (b) acute infection or (c) chronic infection, and (d) the condition of the gingivae of the remaining teeth.
3. The amount of trauma anticipated in removal of the teeth.
4. The estimated shock to the patient.
5. The matter of hospitalization.
6. The wishes and the financial condition of the patient.

THE VARIOUS FACTORS

1. Preoperative examination by a physician is important. His report will determine the feasibility of extensive surgical measures. If the report shows no organic condition and the past history is favorable, there need be no hesitation about performing the necessary operations.

2. Any acute gingival condition should be cleared up. A pericoronal infection should be treated until it is quiescent. If one impaction involves an acute condition and it is believed that drainage and the removal of the tooth are indicated, no more than one tooth should be removed at that time. If there is infection, subacute or chronic, about the four third molars after treatment, other conditions being favorable, the four teeth can be removed.

3. As to possible trauma, personal experience is the only guide. If we know how much difficulty is to be expected in the removal of a tooth or teeth, we can decide on the removal of one, two or as many as is desirable. In the face of uncertainty, it is better to err on the side of safety in determining the number to be removed.

4. Estimation of possible shock also calls for judgment. Provision must be made to treat shock even when one tooth is removed. Removal of a greater number of teeth calls for the same care, but prolongs the period of observation necessary afterwards. Attention to the mental condition, proper premedication and after-care will minimize shock.

5. Hospitalization helps minimize shock and makes control of the case possible. A patient requiring an operation that necessitates a general anesthesia of more than ten minutes is hospitalized or given a local anesthetic in the office. I might remove two simply impacted teeth on one side at one time in my office, but for extraction of two lower third molars or four impacted teeth at one time, I insist on hospitalization, for the patient's protection and incidentally for my own.

6. The wishes and the financial condition of the patient should be considered since some patients take a year or two to nerve themselves for the ordeal of an operation. For them, completion of the work at one time, if possible, has advantages. Also I have found that students frequently prefer to devote a vacation period to recovery from an operation.

On the other hand, workers may find it difficult to take a week off from work when a half day or week-end will suffice. For these patients, a minimum amount of surgical work at one time, e.g. the re-

moval of only one impacted tooth, is indicated.

SUMMARY

A. The equally difficult removal of four impacted teeth does not cause four times the shock, trauma or financial burden associated with removal of one such tooth.

B. Certain conditions can be more or less accurately estimated: (a) the physical condition (by a physician), (b) the condition of the mouth, (c) the need for hospitalization and (d) the wishes and the financial condition of the patient. Conditions other than possible trauma can be anticipated only by the experienced surgeon. The degree of shock can be guessed at and can be reduced by preparation and management, based on the judgment of the operator.

C. Frequently, we see cases in which removal of one impacted tooth causes more trouble than removal of four impacted teeth simultaneously. Then there are the cases that we work on for a long time, causing trauma and laceration, and yet no trouble is experienced afterwards; or the case of a simply impacted tooth that pops out, and dry socket or cellulitis develops afterwards. Surgical judgment based on experience is required to determine when to remove an impacted tooth and how extensive an operation will be necessary.

All of the above-mentioned factors should be carefully analyzed, and in case of a favorable decision, removal of as many impacted teeth as is necessary should be advised.

Report of a Case of Mercurial Poisoning

By I. S. WAGMAN, B.S., D.D.S., Chicago, Ill.

History.—A man, aged 38, complained of an acute gingivitis which had developed after a severe cold. The condition was diagnosed by his physician as trench mouth.

Examination.—Oral examination revealed inflammation of the soft tissues around the necks of the teeth. The gingivae were painful on the slightest pressure and bled freely. The crests of the tissues were separated from the necks of the teeth. No pigmentation was present. A considerable amount of serumal calculus was present. Systemically, the patient complained of severe colicky pains. There was no diarrhea and no loss of weight or appetite, but he looked emaciated. The x-ray examination was negative.

Upon consultation, the physician refused to make a differential blood count and insisted on the removal of all the teeth. At my insistence, a blood count and Wassermann test were made by another physician. The red cells numbered 4,500,000; the white, 17,000. The Wassermann reaction was positive. On further investigation, it was discovered that 84 grains of calomel and Dover's powders had been prescribed for the cold in a period of three days.

Diagnosis.—The case was diagnosed as mercury poisoning.

Treatment and Course.—Sodium hyposulfide injections were instituted immediately. The oral and abdominal symptoms showed immediate improvement and, within two weeks, the condition had completely disappeared.

Comment.—This case is of particular interest because it indicates that close cooperation between the physician and the dentist is often imperative. The refusal of the first physician to cooperate could have brought about a very serious condition.

2756 Division Street.

Unfavorable Reactions of the Mouth Tissues to Materials Used in Denture Construction

JOHN A. HIGGINS, D.D.S., Blue Island, Ill.

For a number of years, rubber was extensively employed in the construction of dentures. This type of material has proved itself to be durable, and with no apparent unwarranted reaction of the oral tissue. An occasional complaint regarding the weight of a vulcanite denture might have been expressed.

In conformity with dental progress, further research in this important phase of dentistry has already been carried out. Much of this research on denture materials has, however, involved the extensive use of chemicals and chemical agents. While great progress has no doubt been made in the general appearance of dentures, reactions to these apparent stable chemical denture materials by the oral tissue must never be overlooked. This precaution should be exercised, since it is known that heat, light and electricity, either independently or collectively, are capable of breaking down chemical unions. In this connection, the contact of hot liquids and hot solid foods with dentures often has detrimental effects on the latter. While these detrimental reactions may appear to be of a minor nature, any cumulative action may prove to be harmful at a later date.

A few case reports will suffice to elucidate this particular phase of dental practice.

REPORT OF CASES

CASE 1.—The wife of a police officer presented herself at the dental office complaining of a burning sensation in the palatal area of the mouth. An upper denture that she was wearing was removed and a very noticeable reddish purple coloration of the palatal tissue was revealed. The denture was retained for further investigation, while the palatal area was treated (swabbed) with an alcoholic solution to which was added a few drops of oil of cloves. After several such treatments of the area, a new vulcanite denture was substituted, and no further trouble was experienced in the palatal area.

CASE 2.—A woman complained of a burning sensation in the palatal area which was present whenever she wore her dentures. Removal of the denture revealed that the palatal area was somewhat inflamed. A diagnosis of vitamin deficiency had been made as the basis of her complaint and the use of alum on the affected area had also been prescribed. After some treatments of the affected area, a vulcanite denture was constructed, and there was no further complaint.

CASE 3.—A man complained of tender gums, a burning sensation in the palatal area and somewhat impaired vision. On removal of the upper denture, the gums were rather soft and tender to the touch. The patient seemed to think that his impaired vision was caused by the condition of his "eye" teeth, which he indicated with his fingers, pointing to the lower right and left cuspid teeth.

An impression for an upper denture was taken at the first sitting. The patient was instructed to wear the old denture while a new vulcanite denture was in the process of construction. When the vulcanite denture was inserted, it firmly gripped the palatal tissue. Within a week after the insertion of the vulcanite denture, the gums had receded to normal, this necessitating a relining of the vulcanite denture for proper retention.

CASE 4.—The patient wore a lower denture that was more or less blistered and somewhat yellowish. The gums seemed normal and there was no history of discomfort.

CONCLUSIONS

Since such active ingredients as phenol, formaldehyde (formalin) and the methyl radicle (methyl methacrylate) are incorporated in dentures, extreme care must be exercised to avoid unfavorable reaction to these compounds. Where phenol is incorporated, we must keep a sharp lookout for possible gangrene. In the case of formaldehyde, we may look for blistered and discolored dentures. Formaldehyde, being a gas and a reducing agent, may be eliminated in such small amounts as to do little if any bodily harm. In case the methyl radicle is incorporated, we should be on the lookout for impaired vision or any action on the optic nerve.

Further investigation and research on all denture materials containing active chemical ingredients should receive the support of the dental profession. General appearances and supposedly stable combinations of chemicals do not guarantee safety, especially where contact with living tissue and the application of heat (hot liquid and hot solid foods) are involved.

13042 South Western Avenue.

CURRENT LITERATURE

Journal of Oral Surgery

July 1943

Titles marked with an asterisk (*) are reviewed below.

*Studies in Bone Healing. W. R. Schram, D.D.S., M.S.D., and L. S. Fosdick, Ph.D., Chicago, Ill.—191.

*Administration of Pentothal Sodium in Specialized Office Practice in Oral Surgery. Berto A. Olson, D.D.S., Hollywood, Calif.—197.

*Complications of Electrosurgery and Their Treatment. Harry Maeth, D.D.S., Mosinee, Wis.—208.

*External Skeletal Fixation of Fractured Mandibles. John Marquis Converse, M.D., New York, N. Y.—210.

*Fractures of the Facial Bones in Children. C. W. Waldron, M.D., D.D.S.; Samuel G. Balkin, M.D., D.D.S., and Ralph G. Peterson, D.D.S., Minneapolis, Minn.—215.

*Correlated Fixation of Mandibular Fractures. Benjamin B. Kamrin, B.S., D.D.S., Brooklyn, N. Y.—235.

*Plastics as a Substitute for Metals in Fracture Appliances. Joseph Freeman, Tuxedo, Manitoba—241.

*Tie-Loop Wiring in the Treatment of Jaw Fractures. Ralph G. Peterson, D.D.S., Minneapolis, Minn.—246.

*Use of Ordinary Small Brass Hinge as Locking Device for Splints in Multiple Fracture of Mandible and Maxilla. J. Orton Goodsell, D.D.Sc., Saginaw, Mich.—250.

*Method of Reinforcing Pulpless Anterior Teeth: Preliminary Report. Alvin E. Strock, D.M.D., and M. S. Strock, D.M.D., Boston, Mass.—252.

Mixed Tumor of the Palate: Report of Case. William C. Wolfe, M.D., and Herman L. Hubinger, D.D.S., Hot Springs, Ark.—256.

*Vertical Impaction of Cuspid in Otherwise Edentulous Mouth: Report of Case. H. Newman Brownson, D.D.S., Hollywood, Calif.—259.

*Mandibular Cyst Treated by X-Rays: Report of Case. Norman Lussier, D.D.S., San Francisco, Calif.—262.

*Iridocyclitis Apparently of Dental Origin: Report of Case. Frank S. Tichy, D.D.S., Evanston, Ill.—265.

*Mixed Tumor of the Palate Presenting Itself as a Cyst: Report of Case. Fred A. Henny, D.D.S., Detroit, Mich.—267.

*Residual Root Cyst of the Mandible: Report of Case. H. Newman Brownson, D.D.S., Hollywood, Calif.—269.

*Handy Bandage. H. Newman Brownson, D.D.S., Hollywood, Calif.—271.

*Foreign Body (Screw) in Mandible: Report of Case. G. Calvin Marlow, D.D.S., San Diego, Calif.—272.

Studies in Bone Healing

THE availability of mineral salts at the site of healing is important in bone repair. If 2 cm. of bone and periosteum is removed from the radius of a dog and not replaced, or if it is decalcified and replaced, fibrous union results. Exclusion of differentiated connective tissue, as by an intact periosteum, is an important factor in bone repair. A bone graft tends to succeed by providing mineral salts and by excluding differentiated tissue. Schram and Fosdick, in experiments here reported, utilized a synthetic paste composed of chemical elements found in bone to furnish the local material required for new bone development. The use of this paste did not permit bony union unless a tantalum foil tubelike barrier was placed around the material between the bone ends to exclude the differentiated neighboring tissue. It was suggested that immobilization made bony repair more certain. The success of these experiments in promoting bone growth without the traditional grafts opens up new vistas. Perhaps defects created by maxillary cysts can be prevented by using bone paste, with or without tantalum. Non-union in fractures where large bone losses are present may be treated or prevented by the use of bone paste and tantalum.

The Administration of Pentothal Sodium in Specialized Office Practice in Oral Surgery

IN 8,203 office cases, pentothal sodium largely displaced nitrous oxide-oxygen in the author's practice. The alcoholic and athletic reacted quite favorably. A trained anesthetist should give the drug. A 2 per cent

pentothal sodium meets the needs of oral surgery and is suggested for possible use in cavity preparations. Children under 12 should not be given this anesthetic. Supplemental nitrous-oxide is sometimes used.

Complications of Electrosurgery and Their Treatment

DELAYED healing is a common postoperative problem in electrosurgery. The variations in liquid content of tissues make it difficult to evaluate electrical resistance. Excessive coagulation sometimes occurs. Cod-liver oil ointment dressings bring widely sloughed areas back to normal in two weeks. Transparent acrylic resin splints hold the ointment in contact with the tissues. Cod-liver oil is also suggested for application in roentgen ray reactions.

External Skeletal Fixation of Fractured Mandibles

SUGGESTIONS in external fixation of fractures include the use of two operators, one maintaining asepsis and the other alining the fragments, intra-orally. A poor site for pins is the symphysis, which allows food and saliva contamination; therefore, pins should be inserted at the inferior border. Pins should be used for fixation, and not manipulation, to prevent skin tension and ulceration and should be inserted through one cortex and into the other. The parotid gland and tooth roots should be avoided if possible. High speed should not be used in pin insertion since heat necrosis may occur. Fine pins are better than those larger than is necessary. Better fixation can be obtained by pin convergence or crossing. Pins are fixed away from possible hematomas. Impaction—firm end-to-end reduction—must be assured before locking the pin units together. Pins are used only where they serve better than some other means; e.g., for edentulous fragments, in large bone defects or during grafting, or where tooth occlusion is not desirable.

Fractures of the Facial Bones in Children

SHOULD fractures occur before a sufficient number of teeth have erupted, treatment is limited to manipulating the parts into position and retaining them there by external means. Ace bandages and plaster Barton bandages are helpful. Circumferentially wired splints are useful over the ridge. In infants, sedation with 20-30 grains of chloral per rectum is adequate. In older children, the teeth that are present may be used as in adults. Wire knots may require soldering. Many wiring methods suitable for use in children's fractures are illustrated, but it is stated that Risdon wires are usually preferable. Labial cast caps with loops or hooks can be utilized where needed. Overlying, accurately cast or acrylic splints can be cemented to or wired onto the teeth. A hook-screw, after the manner of Pohl, adapted to the Roger-Anderson appliance, is suggested for use in those cases in which the fractured bones are grossly displaced or are outside the bounds of retention by other means.

Correlated Fixation of Mandibular Fractures

IN the Army, as in civilian life, it is desirable to cut down the period of hospitalization in fractures as much as possible. The use of multiple loop wiring and elastic reduction followed by sectional acrylic overlay splints solves the majority of problems. Supportive and prophylactic treatment includes a proper diet and sulfonamide therapy.

Plastics as a Substitute for Metals in Fracture Appliances

IT is suggested that a universal headcap for fracture treatment can be made by utilizing plastics (Plexiglas) as a substitute for metal.

Tie-Loop Wiring in the Treatment of Jaw Fractures

A LOOP is made by tying a simple knot in wire. It is then placed in position for use by adapting the whole wire to the neck of a tooth. There are many advantages, the chief of which is that available anchorage is established on the tooth at a maximum distance from the occlusal line.

Use of Ordinary Small Brass Hinge as Locking Device for Splints in Multiple Fracture of Mandible and Maxilla

SOMETIMES it is desirable to employ upper and lower maxillary splints that can be fastened together or separated at will. An ordinary brass hinge, one half of which is attached to the maxillary portion while the other half is fastened to the mandibular section, is utilized as the joining body. Separa-

tion is accomplished by driving the axis pin from the hinge joint and refixation is established by inserting a lock pin or foreshortened nail into the tubular space formerly occupied by the axis pin.

Method of Reinforcing Pulpless Anterior Teeth

ACCORDING to a preliminary report of a method to reinforce incompletely developed roots of anterior teeth, inert metals such as ticonium or tantalum were employed as screws or rods in apices of incisors to add to the length and stability of the roots. Roentgenograms seem to illustrate favorable reactions about the materials used.

Vertical Impaction of Cuspid in Otherwise Edentulous Mouth: Report of Case

AN unerupted cuspid occupied a considerable portion of the diameter of an edentulous mandible. The value of an occlusal view roentgenographically is easily seen. A splint was used postoperatively to stabilize the area and assist in the prevention of fracture.

Mandibular Cyst Treated by X-Rays: Report of Case

X-ray therapy is suggested for tumors or cysts of possible parathyroid origin. The same treatment is recommended for the gland itself. X-ray therapy was used on a "sterile bone cyst" and improvement was noted in the roentgenograms taken over a five-year span.

Iridocyclitis Apparently of Dental Origin: Report of Case

IRIDOCYCLITIS with failing vision was not improved by removal of a few infected teeth. A subsequent examination revealed a radicular cyst. This cyst was removed with marked improvement in vision. Apparently the cyst was the source of the disease.

Mixed Tumor of the Palate Presenting Itself as a Cyst: Report of Case

A PALATALLY appearing, recurrent swelling diagnosed preoperatively as a mucocele turned out to be a mixed tumor of rather extensive proportions. On dissection, the mass extended to the inferiomedial aspect of the angle of the mandible. It is important to note that mixed tumors may present themselves as cysts, and the possibility of underlying tumors must be kept in mind.

Residual Root Cyst of the Mandible: Report of Case

A MANDIBULAR residual cyst, probably started by an injury forty-two years previously, was discovered, occupying a good portion of the mandible in the first and second molar areas. The mass was enucleated under pentothal sodium anesthesia, the bony cavity dusted with sulfanilamide powder and the wound closed, apparently without other dressings. Postoperative x-ray films show a filling of the defect.

Handy Bandage

AN ingenious "handy bandage" for chin support was composed of three sections of cloth material attached to each other by intervening portions of rubber dam, providing a convenient emergency bandage.

Foreign Body (Screw) in Mandible: Report of Case

IN a case showing the presence of a screw in the mandible protruding into the mandibular canal, the history revealed that, twenty-five years earlier, the screw had been placed in the canal in an effort to interrupt the inferior alveolar nerve and abolish tic douloureux. No relief ensued. Alcoholic injections were ineffectual and a "retrogasserian neurotomy" was performed, with elimination of pain until recently. Roentgenograms revealed the screw, which was removed, with cessation of pain.

Effect of Vitamin D on Calcium Retention

H. MCKAY *et al.*

SIX young college women were given a well-selected basal diet supplemented daily by 250, 500 and 750 cc. of milk, respectively, for each of three collection periods of ten days' duration. Subsequently, corresponding diets supplemented by approximately 300 I. U. of vitamin D were given to one subject for one ten-day period and to the remaining five for three ten-day periods each. No evidence was shown of improved calcium retention on vitamin D administration if the daily calcium intake was below 0.8 gm. There was a slight but statistically insignificant increase in calcium

retention if the daily intake was over 0.8 gm. It is concluded that addition of approximately 500 I. U. of vitamin D to the well-selected diet has little influence on calcium retention, and that such a diet automatically provides for the vitamin D needs of a young adult.—*J. Nutrition*, 26:153, August 1943.

DAVID B. SCOTT.

Specificity of Procaine Esterase

BRUNO KISCH

THE youngest member of the family of biologic esterases is one specific for procaine. Köster first discovered a factor in the blood which is able to effect rapid destruction of small amounts of procaine, possibly by enzymatic hydrolysis. The present studies show that procaine esterase is specific and not identical with choline esterase or other esterases. Its probable origin in the liver, its effectiveness in the blood and its property of non-dialysability through membranes all suggest its possible capacity of detoxication by splitting toxic substances which are resorbed into the blood. The esterase is probably a micro-enzyme having the power of very rapid destruction of low concentrations of its substrate, rather than a macro-enzyme which is able to destroy large amounts of proportionately high concentration substrate.—*Exper. Med. & Surg.*, 1:278, August 1943.

DAVID B. SCOTT.

Pharmacology and Toxicology of Sulfonamides

ERNEST P. PICK

THE bacteriostatic effect of sulfonamides without any increase in the defensive powers of the body is significant and occurs only after two to five hours. The pharmacologic action of these substances is associated definitely with growth stimulating and inhibiting processes of micro-organisms. Bacterial resistance to therapeutic action may be developed by the use of inadequate amounts of sulfa drugs. The special pharmacologic action of sulfa drugs depends on their solubility, rate of absorption and excretion and on a satisfactory concentration of the free drug in the body. The dosage depends largely on the method of administration. Among the toxic effects observed in the human body, special differentiation must be made among effects on (1) the central nervous system; (2) thermoregulation; (3) the blood picture; (4) organic damage to liver and kidneys, and (5) skin changes.—*J. Mt. Sinai Hosp.*, 10:343, July-August 1943.

S. J. FANALE.

Gramicidin and Penicillin

WALLACE S. HERRELL

ALTHOUGH gramicidin and penicillin are related substances, the differences in their selective antibacterial activity and probably also in their mode of action are well marked. Gramicidin is a highly effective antibacterial agent for most gram-positive pathogens and is less toxic for tissue than most germicides at present used. It is hemolytic and is restricted to local application and implantation into infected cavities with results that are considered good. The results vary somewhat, depending on the types of lesion and organism. Penicillin is also highly effective against a variety of pathogenic organisms, is less toxic than gramicidin and is not hemolytic. It may be administered locally, subcutaneously, intramuscularly or intravenously without evidence of toxicity. Sound judgment is essential in the management of bacterial infections, and neither of these agents should be used without caution.—*Surg. Clin. No. America*, 23:1163, August 1943.

S. J. FANALE.

Concerning the Infectivity of Saliva in Human Rabies

S. E. SULKIN and C. G. HARFORD

EXCESSIVE salivation is a common feature of paralytic rabies in man. The saliva of two patients who did not report for Pasteur treatment until too late after being bitten by a rabies-infected dog was used for experimentation. (Of thirteen patients bitten by the same dog, ten were treated successfully, two reported too late and one refused treatment. The latter three patients died). The virus was recovered from the saliva, this confirming the previous reports that it may be present. The virus is not always detectable by present laboratory methods. Precautions should be taken by attendants against contact with rabies-infected saliva.—*Ann. Int. Med.*, 19:256, August 1943.

DAVID B. SCOTT.

ANNOUNCEMENTS

ANNOUNCEMENTS must be received by the fifth of the month in order to be published in the forthcoming issue of THE JOURNAL.

CALENDAR OF MEETINGS

DALLAS (TEXAS) MID-WINTER DENTAL CLINIC, January 24-26, 1944.

DENTAL PROTECTIVE ASSOCIATION, Chicago, Ill., December 20.

DISTRICT OF COLUMBIA DENTAL SOCIETY, second and fourth Tuesdays in each month, from October to June, at the United States Public Health Service Auditorium, Washington.

NATIONAL BOARD OF DENTAL EXAMINERS, January 24-25, 1944; May 1-2, 1944.

GREATER NEW YORK DENTAL MEETING, New York, December 6-10.

NEW YORK SOCIETY OF ORTHODONTISTS, New York, November 8-9.

PAN AMERICAN ODONTOLOGICAL ASSOCIATION, New York, N. Y., December 8.

GREATER PHILADELPHIA ANNUAL MEETING, February 2-4, 1944.

ROOT CANAL THERAPY ORGANIZATION, Chicago, February 1944.

STATE SOCIETIES

November

Florida, at Jacksonville (10-11)
Ohio, at Cleveland (7-10)
Tennessee, at Nashville (21-24)

January 1944

Rhode Island, at Providence

March 1944

Minnesota, at St. Paul (1-3)
Wisconsin, at Milwaukee (20-22)

April 1944

Virginia, at Richmond (3-5)

May 1944

Georgia, at Atlanta (7-10)

STATE BOARDS OF DENTAL EXAMINERS

Alabama, at Birmingham, November 29. Farrar McCrummen, 1006 Woodward Bldg., Birmingham, Secretary.

Arizona, at Phoenix, November 15. R. K. Trueblood, 25 N. Second Ave., Glendale, Secretary.

California, at Los Angeles, November 29. Kenneth I. Nesbitt, 515 Van Ness Ave., San Francisco, Secretary.

Connecticut, at Hartford, December 7-11. Clarence G. Brooks, 302 State St., New London, Recorder.

Florida, at Jacksonville, November 29-December 2. L. D. Pankey, 138 Alhambra Circle, Coral Gables, Secretary.

Kentucky, at Louisville, November 16-19. W. F. Waltz, 1114 First Nat'l Bank Bldg., Lexington, Secretary.

Massachusetts, at Boston, December 27-29. William H. Canavan, 413-N State House, Boston, Secretary.

Minnesota, at Minneapolis, December 13-18. G. R. Metcalf, Barnesville, Secretary.

New Jersey, January 10-15, 1944. J. F. Burke, 150 E. State St., Trenton, Secretary.

North Carolina, at Raleigh, December 27. Wilbur Jackson, Rich Bldg., Clinton.

Ohio, at Columbus, November 29-December 1. Earl D. Lowry, 79 E. State St., Columbus, Secretary.

South Carolina, at Columbia, December 20-22. T. C. Sparks, 1508 Washington St., Columbia, Secretary.

Tennessee, at Memphis, December 5-8. W. W. Martin, 115 W. Jefferson, Pulaski, Secretary.

Virginia, at Richmond, January 4, 1944. John M. Hughes, 715 Medical Arts Bldg., Richmond, Secretary.

Wisconsin, at Milwaukee, November 8-12. S. F. Donovan, Tomah, Secretary.

NATIONAL BOARD OF DENTAL EXAMINERS

THE following are the dates for the next examinations of the National Board of Dental Examiners: January 24-25, 1944; May 1-2, 1944. The dates of the 1944 examinations are subject to change after the executive committee meeting of the Board in

Cincinnati in October. Applications should be sent through deans.

GORDON L. TEALL, *Secretary.*

DALLAS MID-WINTER DENTAL CLINIC

THE seventeenth annual meeting of the Dallas Mid-Winter Dental Clinic will be held January 24-26, 1944. For further information, address

J. R. TIPTON, *Secretary,*
Medical Arts Bldg.,
Dallas, Texas.

DENTAL PROTECTIVE ASSOCIATION

THE annual meeting of the Dental Protective Association of the United States will be held at the Palmer House, Chicago, December 20, at 5 p.m.

E. W. ELLIOT, *Secretary,*
55 E. Washington St.,
Chicago, Ill.

GREATER NEW YORK DENTAL MEETING

THE next Greater New York Dental Meeting will be held in the Hotel Pennsylvania, New York, December 6-10.

S. A. ISAACSON, *Chairman,*
Press and Publication Committee,
Room 106A,
Hotel Pennsylvania,
New York.

NEW YORK SOCIETY OF ORTHODONTISTS

THE fall meeting of the New York Society of Orthodontists will be held at the Hotel Waldorf-Astoria, New York, November 8-9.

NORMAN L. HILLYER, *Secretary,*
Professional Bldg.,
Hempstead, N. Y.

PAN AMERICAN ODONTOLOGICAL ASSOCIATION

BECAUSE of transportation difficulties, due to war conditions, the seventh annual dinner meeting of the Pan American Odontological Association will be abbreviated to include primarily the executive committees. The meeting will be held at the Hotel Pennsylvania, New York, December 8, at 7 p.m.

RALPH HOWARD BRODSKY,
Executive Secretary,
14 E. 81st St.,
New York, 28, N. Y.

GREATER PHILADELPHIA ANNUAL MEETING

THE Greater Philadelphia Annual Meeting will be held February 2-4, 1944 at the Benjamin Franklin Hotel.

JOHN P. LOOBY, *Chairman,*
Publicity Committee

ROOT CANAL THERAPY ORGANIZATION

AT the Midwinter Meeting of the Chicago Dental Society, a national group for the study of root canal therapy was organized. W. Clyde Davis was made president, and John H. Hospers, secretary-treasurer. Committees were appointed to draw up a constitution and to select a name, to be submitted at the next regular meeting, in Chicago in February 1944. It is hoped that all those who are interested in this fundamental phase of dentistry will associate themselves with the group. Those joining before the final organization will be considered charter members. Annual dues were temporarily set at $2. All correspondence should be addressed to

JOHN H. HOSPERS, *Secretary,*
25 E. Washington St.,
Chicago, Ill.

FLORIDA STATE DENTAL SOCIETY

THE Florida State Dental Society will hold its next annual meeting November 10-11 at the George Washington Hotel, Jacksonville.

HORACE L. CARTEE, *Secretary,*
Huntington Building,
Miami.

GEORGIA DENTAL ASSOCIATION

THE seventy-sixth annual meeting of the Georgia Dental Association will be held in Atlanta, May 7-10, 1944, with headquarters at the Ansley Hotel.

R. H. MURPHY, *Secretary,*
605 Bankers Insurance Bldg.,
Macon.

MINNESOTA STATE DENTAL ASSOCIATION

THE sixty-first annual session of the Minnesota State Dental Association will be held in the Municipal Auditorium, St. Paul, March 1-3, 1944. All members of the American Dental Association are invited to attend.

L. M. CRUTTENDEN, *Secretary,*
498 Lowry Bldg.,
St. Paul.

OHIO STATE DENTAL SOCIETY

THE next annual meeting of the Ohio State Dental Society will be held in Cleveland, November 7-10.

EDWARD C. MILLS, *Secretary,*
255 E. Broad St.,
Columbus.

RHODE ISLAND STATE DENTAL SOCIETY

THE next meeting of the Rhode Island State Dental Society will be held in Providence in January 1944.

CHARLES F. MCKIVERGAN,
Secretary Pro Tem.,
102 Waterman St.,
Providence.

TENNESSEE STATE DENTAL ASSOCIATION

THE Tennessee State Dental Association will hold its sixty-sixth annual meeting in Nashville, November 21-24, at the Hotel Andrew Jackson.

E. JEFF JUSTIS, *Secretary,*
Exchange Bldg.,
Memphis.

VIRGINIA STATE DENTAL ASSOCIATION

THE Virginia State Dental Association will hold its next annual meeting April 3-5, 1944 at the John Marshall Hotel, Richmond.

J. E. JOHN, *Secretary,*
Medical Arts Bldg.,
Roanoke.

WISCONSIN STATE DENTAL SOCIETY

THE Wisconsin State Dental Society will hold its seventy-fourth annual convention at the Hotel Schroeder, Milwaukee, March 20-22, 1944. A meeting of the executive council and house of delegates will precede the general convention March 19, 1944.

KENNETH F. CRANE, *Secretary,*
1233 Bankers Bldg.,
Milwaukee.

ALABAMA BOARD OF DENTAL EXAMINERS

THE next examination of the Alabama Board of Dental Examiners will be held November 29 in Birmingham. Credentials and fees must be in the hands of the secretary two weeks in advance of the examination. For application forms and further information, address

FARRAR MCCRUMMEN, *Secretary,*
1006 Woodward Bldg.,
Birmingham.

ARIZONA STATE DENTAL BOARD

THE next examinations to be conducted by the Arizona State Dental Board for licensure in the State of Arizona will be held in Phoenix commencing November 15. All credentials must be in the office of the secretary November 1. Address all communications to

R. K. TRUEBLOOD, *Secretary,*
25 N. 2nd Ave.,
Glendale.

BOARD OF DENTAL EXAMINERS OF CALIFORNIA

THE next examinations to be conducted by the Board of Dental Examiners of California for licensure in the State of California will be held in Los Angeles commencing November 29. All credentials must be in the office of the secretary, Room 203, 515 Van Ness Ave., San Francisco, at least twenty days prior to the examinations. Address all communications to

KENNETH I. NESBITT, *Secretary.*

CONNECTICUT DENTAL COMMISSION

THE Connecticut Dental Commission will meet in Hartford, December 7-11, for examination of applicants for license to practice dentistry and dental hygiene and to transact any other business proper to come before it. Applications should be in the hands of the recorder at least ten days before the meeting. For application blanks and further information, apply to

CLARENCE G. BROOKS, *Recorder,*
302 State St.,
New London.

FLORIDA STATE BOARD OF DENTAL EXAMINERS

THE Florida State Board of Dental Examiners will hold its annual examination of applicants for license to practice dentistry or dental hygiene in Florida at Jacksonville in the Seminole Hotel, November 29-De-

cember 2. Candidates for dental licenses must file preliminary applications by September 28. Final applications for dentists and dental hygienists must be complete by October 28. Address all communications to

L. D. PANKEY, *Secretary,*
138 Alhambra Circle,
Coral Gables.

KENTUCKY STATE BOARD OF DENTAL EXAMINERS

THE next meeting of the Kentucky State Board of Dental Examiners will be held November 16-19, at the University of Louisville Dental School, Louisville. Dentists having graduated prior to 1943 and desiring to stand examination before this board must file applications, complete with full information requested, at this office not later than September 16. Applications of 1943 graduates must be in the secretary's office by October 16. Dental hygienists having completed a two year hygienist course and desiring to stand examination before this board must file applications by October 16. Ample time should be allowed for securing all data required. For application forms and further information, address

W. F. WALZ, *Secretary,*
1114 First Nat'l Bank Bldg.,
Lexington.

MASSACHUSETTS BOARD OF DENTAL EXAMINERS

THE Massachusetts Board of Dental Examiners will hold its next examinations December 27-29. All applicants must file their credentials with the secretary at least thirty days in advance. For further information, address

WILLIAM H. CANAVAN, *Secretary,*
413-N State House,
Boston.

MINNESOTA STATE BOARD OF DENTAL EXAMINERS

THE next examination of the Minnesota State Board of Dental Examiners will be held at the College of Dentistry, University of Minnesota, Minneapolis, December 13-18. All examination fees must be in the hands of the secretary at least ten days before the date of the examination. Address all communications to

G. R. METCALF, *Secretary,*
Barnesville.

STATE BOARD OF REGISTRATION AND EXAMINATION IN DENTISTRY OF NEW JERSEY

THE State Board of Registration and Examination in Dentistry of New Jersey will hold its next examinations January 10-15, 1944. A copy of the requirements and rules, instruction sheet and preliminary application blank will be sent on request. Preliminary application blanks, together with the examination fee of $25, should be sent to the secretary on or before November 15.

J. F. BURKE, *Acting Secretary,*
150 E. State St.,
Trenton.

NORTH CAROLINA STATE BOARD OF DENTAL EXAMINERS

THE next meeting of the North Carolina State Board of Dental Examiners for the examination of applicants for licensure will be held at the State Capitol, Raleigh, beginning December 27. Applications must be filed with the secretary thirty days before the examination. For application blanks and further information, address

WILBUR JACKSON, *Secretary,*
Rich Bldg.,
Clinton.

OHIO STATE DENTAL BOARD

THE practical examination of the Ohio State Dental Board will be held at Ohio State University College of Dentistry, Columbus, November 29-December 1. The practical examination may be taken either in Cleveland or in Columbus, provided due notice is given to the secretary. The theory examination will be held in Columbus, December 2-4. All applications must be in the hands of the secretary at least ten days before the examination. For further examination, apply to

EARL D. LOWRY, *Secretary,*
79 E. State St.,
Columbus.

SOUTH CAROLINA STATE BOARD OF DENTAL EXAMINERS

THE South Carolina State Board of Dental Examiners will hold its next meeting in Columbia December 20-22. All applications

must be filed with the secretary at least thirty days before the examinations.

T. C. SPARKS, *Secretary,*
1508 Washington St.,
Columbia.

TENNESSEE BOARD OF DENTAL EXAMINERS

THE Tennessee Board of Dental Examiners will hold its next examination at the College of Dentistry, University of Tennessee, Memphis, December 5-8. All candidates must report to the board at 1 p.m., Sunday, December 5, at the Peabody Hotel, ready to take the examination. For further information, address

W. W. MARTIN, *Secretary,*
115 W. Jefferson Ave.,
Pulaski.

VIRGINIA STATE BOARD OF DENTAL EXAMINERS

THE next meeting of the Virginia State Board of Dental Examiners will be held at the Medical College of Virginia, Richmond, beginning at 9 a.m., January 4, 1944. No applications will be accepted after December 20. Incomplete applications will be rejected and returned. For application blanks and further information, address

JOHN M. HUGHES, *Secretary,*
715 Medical Arts Bldg.,
Richmond.

WISCONSIN STATE BOARD OF DENTAL EXAMINERS

THE Wisconsin State Board of Dental Examiners will conduct its next examination November 8-12, at Marquette University College of Dentistry, Milwaukee. For further information, address

S. F. DONOVAN, *Secretary,*
Tomah.

VOLUNTEERSHIPS AND EXTERNSHIPS, BRONX HOSPITAL

THERE are several volunteerships and externships available for recent graduates at the dental clinic, Bronx Hospital, in the following departments: oral surgery and exodontia, operative dentistry, orthodontia, surgical periodontia and root canal therapy. Applicants address David Wurzel, director of the Dental Department, Bronx Hospital, 169th St. & Fulton Ave., Bronx, New York.

DENTAL INTERNSHIPS

Two internships are available at the St. Louis City Hospital for recent dental graduates. Opportunity is afforded for training and experience in dental and oral surgery, diagnosis and other phases of dentistry. Applicants should address Leo J. Wade, Medical Director, or Hamilton B. G. Robinson, D.D.S., City Hospital, 1515 Lafayette Ave., St. Louis, Mo.

DENTAL INTERNSHIPS

THE Greater New York Conference of Hospital Dental Services, comprised of a group of men who are chiefs of dental services, would like to aid those men seeking dental internships in hospitals in the metropolitan area. Those who are not in the Army or the Navy and who are desirous of obtaining internships should communicate with

MARY E. REILLY, *Secretary,*
386 Fourth Ave.,
New York, N. Y.

EXAMINATION FOR APPOINTMENT IN THE DENTAL CORPS OF THE NAVY

THE next examination for appointment as Assistant Dental Surgeon, U. S. Navy (lieutenant [junior grade], Dental Corps, U. S. Navy) will be held at the Naval Training Station, Norfolk, Va., the Naval Training Station, Great Lakes, Ill., the Naval Training Station, San Diego, Calif., and the Naval Dental School, National Naval Medical Center, Bethesda, Md., January 24, 1944. Application for this examination should be made to the chief of the Bureau of Medicine and Surgery, Navy Department, Washington, D. C. Applicants for appointment as Assistant Dental Surgeon must be citizens of the United States, more than 21, but less than 32 years of age at the time of acceptance of appointment, and graduates of a Class A dental school. A circular of information listing physical and other requirements for appointment, subjects in which applicants are examined and other data pertaining to salary, allowances, etc., can be obtained from the Bureau of Medicine and Surgery, Navy Department, Washington, D. C., on request.

NEW YORK UNIVERSITY COLLEGE OF DENTISTRY POSTGRADUATE COURSE

NEW York University College of Den-

tistry announces a postgraduate course in inhalation anesthesia, with special emphasis on nitrous oxide-oxygen anesthesia, conducted by E. A. Rovenstine, professor of anesthesia, N. Y. U. College of Medicine and Bellevue Hospital, and A. S. Mecca, assistant professor of oral surgery, N. Y. U. College of Dentistry and Bellevue Hospital. The course, consisting of lectures and practical demonstrations conducted in six successive three-hour morning sessions, will deal with the theory and practice of general anesthesia in ambulatory cases, and patients cared for in private practice. To give the student a sound foundation and background, the mechanics of anesthesia and the principles and technic of administration will be discussed. Special attention will be given to the examination of the patient, proper steps in positioning and principles of administration. With respect to the technic of administration, the cardinal points in symptomatology, complications and emergencies will be stressed. A detailed study will be made of postoperative observation of patients, bearing directly on psychologic principles and rest.

The course will be given on Friday mornings, October 22 to November 26. Classes will begin at 9 a.m. and continue to 12 noon.

Direct all communications to the Office of the Dean, N. Y. U. Dental College, 209 East 23rd St., New York, N. Y.

FEDERAL POSITIONS FOR DENTAL HYGIENISTS

THE United States Civil Service Commission is continuing to recruit dental hygienists for federal positions. Experience is no longer necessary. Completion of a full course leading to graduation from a recognized school of oral hygiene and registration as a dental or oral hygienist in a state, territory or the District of Columbia will qualify applicants. Students enrolled in schools of oral hygiene may apply for federal positions when they are within nine months of completion of the course and may enter on duty on completion and registration. There are no age limits for the positions and no written tests. Appointees receive $1,970 a year entrance salary, which incorporates compensation for the eight hours of overtime included in the present forty-eight hour federal work week. The majority of positions are in Army hospitals and dispensaries throughout the country, particularly in the West and Southwest. Vacancies may occur also in the Veterans' Administration and the Public Health Service. Applications should be filed with the Civil Service Commission, Washington, 25, D. C.

W. C. HULL, *Executive Assistant,*
United States Civil Service Commission,
Washington, D. C.

CARNEGIE FELLOWSHIPS FOR RESEARCH AND GRADUATE WORK IN THE DENTAL SCIENCES

AIDED by the Carnegie Corporation of the New York and the Eastman Dental Clinic, the School of Medicine and Dentistry of the University of Rochester offers scholarships paying $1,200-$1,800 per annum to well-trained dental graduates who are interested in research or who desire special training in the basic medical sciences as an aid to dental teaching or practice. A few fellowships also offer part-time training in oral surgery. On appointment, the applicant is given the title of Fellow in Dentistry and, according to his interests, works as a graduate student in one of the departments of the medical schools. Here, excellent laboratory facilities, adequate direction and close contact with various investigations related to medicine and dentistry help his research and study. Fellows are encouraged to attend medical classes, seminars and staff meetings and, when opportunity presents itself, to participate in class instruction and scientific meetings. Contact with the problems of clinical dentistry may be maintained through the Oral Surgery Clinic of the Strong Memorial Hospital and the Rochester Dental Dispensary. With the approval of the Graduate Council of the university, Fellows may prepare themselves for the degree of M.S. or Ph.D. Applications should be made to

GEORGE H. WHIPPLE, *Dean,*
Rochester, N. Y.

UNITED STATES PATENTS APPLICABLE OR PERTAINING TO DENTISTRY ISSUED DURING JUNE, JULY AND AUGUST 1943

June 1

2,320,826, FRITZ W. MANDEL. Method and means for making dental plates.

June 8

Re.22,331, SIMON MYERSON. Artificial tooth.
2,321,265, GEORGE ULVICK, Toothbrush.

June 22

2,322,325, MICHAEL RUSSELL STEIN AND HENRY KARLIN. Denture.
2,322,735, NICHOLAS M. MOLNAR. Hemostatic, analgesic and bactericidal composition of matter.

June 29

2,322,753, GEORGE J. THOMAS. Surgical apparatus.
2,323,159, ARTHUR E. SMITH. Syringe.

July 6

2,323,378, RAYMOND D. CHAMPION. Liquid dispensing device.
2,323,645, HARRY R. CLAUSEN. Dentist drill control.
2,323,685, CLAWSON P. SKINNER. Partial denture.
2,323,704 FRED R. CAMPBELL. X-ray fluoroscopic and radiographic apparatus.

July 13

2,324,025, JOHN H. RAVELL. Dental tool grinder.

July 20

2,324,789, DANDY J. MAYEUX. Midget toothbrush.
D-136,042, CHARLES KENNETH VEO. Design for a toothbrush.

July 27

2,325,051, CHARLES VICTOR GROSS. Dental impression compound.
2,325,300, HARRY L. BISNOFF. Fracture appliance.

August 10

2,326,271, ERNST WESSINGER. Dental vulcanizing flask.
2,326,531, WILLIAM ELLIOTT FREW GATES. Coloring of synthetic resinous compositions.
2,326,632, BENJAMIN FRIEDMAN. Interchangeable toothbrush.
D-136,156, CLARENCE W. FULLER. Design for a toothbrush.

August 17

2,327,203, OLIN G. MCKENZIE. Dental instrument.

August 24

2,327,347, FLOYD E. GIBBIN. Saliva ejector.
2,327,548, ABRAM J. PEARLMAN. Jacket crown.
2,327,707, LEO A. HEINTZELMAN. Sterilizer.

August 31

2,328,048, JULIAN H. BAIR. Fountain implement.
2,328,105, LOUIS J. STROBINO. X-ray shield.
2,328,213, GEORGE M. HOLLENBACK. Amalgamator.
2,328,285, SEYMOUR E. MACDOUGALL. Dental flask.
2,328,379, REINER W. ERDLE. Artificial tooth.